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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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FIFTH ANNUAL MEETING OF THE AMER. GAS LIGHT ASSOCIATION.

The fifth annual meeting of the Association will be held at Cincinnati, O., on Wednesday, Oct. 17, 1877. Members are requested to prepare papers on any subject connected with gas matters, and to confer with the Secretary concerning the same. CHAS. NETTLETON, Sec'y.,
117 Broadway, New York.

GAS PURIFICATION.

We call the attention of our readers to the report following of a Commission appointed by the Court in the Philadelphia case of nuisances arising from the gas works. The full report of the case was published at the time, and this report gives the results of experiments, both in a larger and a smaller way, which will prove of great value wherever it is desirable to use lime purification. The process is inexpensive, and would seem, from the report, to give satisfactory results.

A FEW MORE FRANK WORDS.

Since the publication of our last issue, June 16, in which we allowed Mr. George S. Dwight space for "a few frank words" regarding the "Lowe process and its managers," there has come into our hands some other frank words regarding the same process, and interesting to the managers and the public. We venture to give a few extracts from a correspondence, dated at No. 87 Astor House. New York, Feb., 1877, plainly indicating that the gentlemen conducting the enterprise in hand are sagacious men and will endorse the Lowe process so long as it will give them "Bonds and Stock."

No. 87 ASTOR HOUSE, New York, Feb., 1877.

DEAR SIR:—Your several favors received. All efforts with old gas companies seem to prove fruitless. Your idea in relation to Blank & Bland is the true course. Obtain charter and concessions from cities, if possible, in relation to municipal consumption, street lights, etc., and organize a new company under the auspices of prominent citizens, the largest consumers.

Capitalize and bond the Co. giving bonds at about 90 per cent. and a *bonus* of say 25 per cent. stock for money to build the works. * * * *

To lay a certain number of miles of pipe and build works will require a certain sum of money. The idea would be for you and I and associates to take the contract to do this work at a price that will leave us some money, also stock and bonds in addition.

We can settle with Blank in kind, *i. e.*, in the stock and bonds of any company to be organized.

Pipe also can be had upon a kindred basis—so that is equal to capital cash subscribed—in short, the way is to organize a company, and then I will find some one to take control on a profitable basis, we to share the profits in kind—cash, bonds and stock. Paying out only 25 per cent. of the stocks we might become the owner of three-quarters of the stock. This is all a matter of details and negotiation.

To lay, say 30 miles of pipe, and to build works to correspond, would cost say $250,000, and each additional 20 miles say $20,000 more. This gives you a tolerable safe guide.

Now, say for works to be built of this capacity, we should calculate upon bonding it to the extent of not less than $600,000. Old gas companies have stock and bonds and pay dividends and interest. Pipe can be had for $35 per ton. So make up your mind that gas works can be built very cheap, and with our process, and not having an artificial or inflated indebtedness, will have a decided advantage.

Blank & Co. are no longer willing to give absolute guarantees, success has been demonstrated and is open to investigation. The price upon which gas can be made depends upon the price of crude oil, naphtha, etc. Where coal is high the Lowe process will have comparatively an advantage of coal gas works. A very handsome saving may be effected in one locality and not so much in another. The reasons will be obvious to you at a glance.

In ——— the Lowe process will come in play magnificently. Under all circumstances my advice is, *entre nous*—if you have encouragement—go ahead, and, when the proper time comes, conflicting interests—if any—can be harmonized or strengthened by combining—you understand. I can fix that here. The most vital question is to get the charter—concessions, if possible, from the city; stock and bonds subscribed for; citizens committed to take the gas—all other matters can be subsequently arranged.

I have endeavored to write somewhat fully to you, giving you the benefit as to what I know of the course pursued here in reference to organizing new companies. You will find it a waste of time fooling with old companies, as I have previously told you.

Very truly yours,

There—these are frank words, easily understood. Bonds and stock, no inflated indebtedness—there. Will cost $250,000. Bonded for not less than $600,000, and how much stock not mentioned.

We wonder how these "few frank words" impress the purchasers of bonds and stock in Baltimore and Lancaster and Indianapolis. We commend them for their serious consideration.

Childrens Hospital vs. Bumm and Others
Final Report of Commission.

FILED JUNE 11TH, 1877.

To the Honorable James R. Ludlow, President Judge Court of Common Pleas, No. 3:—
[Philadelphia, Pa.]

The undersigned, a commission appointed by an order of the court, dated December 11th, 1876, in the case of "The Children's Hospital *et al. vs.* Bumm *et al.*," to present "a specific and detail-method and plan whereby, in their opinion, the everal complaints set forth in the bill herein can

be redressed, and the time required to accomplish the same," hereby beg leave to present the following report:—

In the first place, a previous commission having been appointed in this case, and having reported upon the general question of the gas nuisance involved in it, and their report having been referred to us, we desire to say that we have given this report careful examination, with a view to test the justness of its conclusions. We entirely agree in and hereby desire to reiterate the statements therein made concerning the Market Street Gas-Works, their location, capacity, and general management. We entirely agree with the previous commission, when they assert that the possible causes of offense arising from the manufacture of gas in any locality are two in number: the one special, being due to the disagreeable odors arising from the materials used in purifying the gas and which are "fouled" in the process—in the present case the spent lime; and the other, general, being due to the odors and appearance of the escaped steam, smoke and gas in the processes of manufacture. We agree that the former of these causes of nuisance, which was, in the main, the one complained of at the time the former commission was appointed, is one which is quite unnecessary, and which is entirely preventable by suitable chemical means. The latter of these causes is one which is inseparable from the manufacture itself, and which, therefore, although reducible to a minimum, cannot be altogether prevented.

Believing that the object had in view in appointing the present commission was to ascertain the best method of reducing the nuisances incident to the manufacture of gas to a minimum, we have confined ourselves to the investigation of the two classes of odors above mentioned. In the report of the former commission, it recommended, in order to obviate the spent-lime nuisance, either that the process for ventilating the lime fouled in the purifiers should be made much more efficient, or that an improved process of purification should be introduced, combining the advantages of both the iron and the lime methods. On taking up this question anew, your commission found that, while either of the suggestions mentioned was entirely feasible and would undoubtedly be effective, yet the exceeding great pressure upon the works, especially heavy during the winter season, made it quite impossible to introduce the alterations needed to put either of these processes into operation, without seriously endangering the supply of gas to the districts dependent upon these works. Moreover, a simpler method of attaining the desired end had, in the mean time, been suggested by the chemists of the commission. The disagreeable odors which characterize the spent lime, and which are the causes of complaint in this case, being due to the presence of volatile substances, chiefly perhaps, to ammonia and ammonium compounds, it became evident that, if by any convenient means, these substances could be removed from the gas before its reaching the lime, the exhausted material from the purifiers, having now no offensive volatile matters contained within it, could no longer be a cause of nuisance. In other words, the method suggested was a process for preventing the offensiveness of gas lime by removing from the gas its injurious volatile constituents before it passes to the lime purifiers. The theory of the new method appearing so satisfactory, it was resolved to undertake an investigation of it in practice, using for this purpose the experimental works at the Market Street station. On the 23d of December, one of the experimental purifiers was charged with five bushels of sawdust, thoroughly moistened with sulphuric acid of 50° Baume, arranged in three equal horizontal layers. The other two purifiers were charged as usual with lime, four bushels, also in three layers, being placed in each purifier. The fires under the retorts were then lighted, and the gas produced, after passing the experimental condenser and scrubber, was conducted first through the purifier containing the sawdust and sulphuric acid, and then through the lime purifiers. On the 29th of December, the first lime-box "fouled," and on the 30th, the second; the amount of gas purified by them having been 47,100 feet. On opening these purifiers—each bushel of lime in which had purified nearly 6000 cubic feet of gas—the lime appeared of a more or less dirty yellow color, looking very much like that spent by the old process. The odor arising from it, however, even when shovelled into the barrows, was inconsiderable; so much so that both purifiers were emptied and recharged in the rather small purifying room without inconvenience either to the workmen or to the other persons present. Hence it was proved that the action of the acid had removed volatile offensive materials from the gas, thereby preventing their absorption by the lime, thus enabling the lime to be thoroughly spent, or "fouled," as the workmen call it, without becoming offensive either at first or, subsequently, on exposure to the air.

Deeming it desirable, in an economical point of view, to test the method up to the point at which the acid mixed with the sawdust became saturated, the experimental works were kept in operation until the 6th of April, when the acid box was reported "foul." On observing the meter, it appeared that 1,590,210 cubic feet of gas had passed through the five bushels of sawdust and acid, thus proving that one bushel of this sawdust was capable of purifying 318,042 cubic feet of gas.

So satisfactory was this result regarded that in January the chief engineer of the gas-works brought the new process to the attention of the trustees, with the recommendation that it be adopted in the Market Street works. The plan having been approved, the working drawings of the new acid purifiers required, together with their necessary connections, were at once prepared and their construction begun without delay. One of the three sets of purifiers needed was completed, placed in position and charged with sixty-seven bushels of the acid sawdust on the last week in March. On Friday, the 6th of April, the first lime purifier was "fouled" by gas which had passed through the acid box. On opening it, the lime appeared to be in much the same condition as that "fouled" in the experimental works, having a dirty, yellow color, but possessing only a slight aromatic odor, not at all disagreeable. Moreover, the gas itself which had been thus purified was remarkably devoid of odor also. The two additional acid purifiers required were finished and put into operation within the subsequent fortnight, so that on the 30th of April, when a conference was had at the works, the whole of the gas manufactured there had been for some days purified by the acid before entering the lime boxes. It was observed, however, that owing to the less perfect removal of the volatile matters from the gas in the washers or scrubbers of the main works, compared with that in the experimental works, the acid in the large purifiers became "fouled" sooner than that in the experimental purifier. One bushel of the acid sawdust, when used in the main works, appears capable of purifying fifty thousand cubic feet of gas only, instead of three hundred thousand feet, as before mentioned. The new process is now in full practical operation at the Market street works, the necessary changes to accommodate and work it succesfully having been readily made, and the minor details having been well attended to.

With reference to this essentially new process of lime purification it may be claimed—

1. That it is efficient. It removes the ammonia and other volatile matters so completely from the gas that the lime subsequently used to remove the sulphur has, when spent, scarcely any appreciable odor, and absolutely no disagreeable one. Properly used, therefore, it enables the retention of the lime process for purifying gas, a process universally conceded to be the best for the purpose, and reluctantly given up only because of the intolerable nuisance of the spent lime. Moreover, the new process removes, in large part, the disagreeable odor of the gas itself.

2. That it is inexpensive. The cost of the process is, first, that of the purifying material, and second, that of the additional plant. With regard to the material, even were the gas company obliged to purchase it, it could be had for twenty cents a bushel; and as one bushel purifies fifty thousand feet of gas, the cost per thousand cubic feet would be but two-fifths of a cent—an insignificant sum. But the company is not obliged to purchase it. The acid by combining with the volatile matters in the gas forms ammonium sulphate and other products valuable in the arts. So that the manufacturing chemist is not only quite willing to furnish the sawdust saturated with acid free of charge, but is willing also to deliver it to and to remove it from the gas works at his own expense—this arrangement being the one now actually in operation at the Market street works. As to the increased plant, the cost need not be considerable, since only an additional purifier is required, and that not a large one, for each main. Even this expense might be avoided by using one of the ordinary lime purifiers as an acid box.

3. That it considerably lessens the cost of gas purification. During the year 1876, by the report of the Gas Trust, the gas made in the city of Philadelphia, amounting to two billions one hundred and fifty-four millions two hundred and eighty-one thousand (2,154,281,000) cubic feet, was purified by four hundred and fifty thousand seven hundred and eighteen (450,718) bushels of lime, being nearly five thousand feet purified by one bushel of lime. Experiments with the new process show that a lime purifier, which ordinarily runs for two and a-half days at these works and purifies two million cubic feet of gas, will run three days when placed after an acid box and purify twenty four hundred thousand cubic feet; thus increasing the number of cubic feet purified by one bushel of lime to six thousand cubic feet, in round numbers—an actual saving of twenty per cent. On the gas made in Philadelphia during the past year, therefore, there would be a saving of eighty thousand bushels of lime, which at five cents per bushel—the lime being taken as slaked—would amount to considerably more than $4,000.

In view of the statements above made—the results of experiments carefully conducted—your commission is of opinion that the new process now described may not only obviate entirely the gas-lime nuisance complained of, but may also materially benefit the gas manufacture, first, by rendering lime purification possible, and second, by reducing the amount of this substance which is needed for the purpose.

In relation to the nuisance which arises from the second class of odors, above enumerated, the commission desires to say that it has given especial attention to the questions it involves. In order to make coal gas, bituminous coal is shoveled into red hot retorts. From the mouths of these, during this process of charging, gases and smoke necessarily escape, Moreover, the fire by which the retort is heated discharges its smoke and combustion products into the interior of the retort house. In the third place, at the close of a heat, after the charge has been exhausted of gas, the retort-lids are opened and the coke is raked out into barrows. During this process it comes in contact with a small amount of tar which has been deposited just within the mouth of the retort during the heating, and, being red hot, it volatilizes this tar, giving rise for a few moments to a dense yellow smoke. The coke is taken without the retort house and quenched with water. The steam which it evolves in clouds is entirely odorless and harmless. The time allowed for burning off a charge being four hours, it is obvious that if the fire be not properly attended to, the coal in the retort will not be properly carbonized, and, therefore, will emit smoke when drawn into the barrows.

There is necessarily an odor of gas and of gas-tar about a gas works, arising from the many small escapes of gas from changing the scrubbers and purifiers and the like, as well as from handling and treating the ammoniacal liquor and the gas tar on the premises. Inasmuch as all the ordinary operations of a gas works must be performed by unskilled labor, it is absolutely necessary to allow to this labor a somewhat wide mar-

gin of carefulness within which to work. Upon a careful examination of the processes of gas manufacture as conducted at the Market street works, and a comparison of them with those of other gas works of similar magnitude in other cities, we have not been able to perceive that the former are at all inferior to the best establishments elsewhere. So far, therefore, as this second class of odors is concerned, we are of the opinion that the minimum production of these odors which the works in question have already attained, is, to say the least, not above that of any similar works in the United States.

Two facts, however, having an important bearing on this case, should here be mentioned. In the first place, the work performed at the Market street station during the past winter has been exceptionally heavy, the production of gas in December averaging four million cubic feet per diem. while at present scarcely two million five hundred thousand cubic feet is produced daily. Secondly, a new gas works of considerably greater magnitude than any at present in operation in this city, is now in process of construction in the Twenty-fifth Ward, on the Delaware River. The progress already made warrants the expectation that the works will go into operation in the fall of the present year, provision being made for increasing their capacity as may be required up to a production of nine million cubic feet per day. There is no reason to believe, therefore, that the Ninth Ward works will ever again be taxed as severely as they were during the past winter. With a production of gas easily suited to their capacity, and with the improved processes of purification already adopted in full practical use, your commission cannot but believe that all the nuisances complained of will be entirely abated, in so far as they are preventable at all, without the removal of the works.

In conclusion, and by way of recapitulation, the commission desires to express its belief—

First.—That the spent-lime nuisance, the one referred to in the third prayer of the bill of complaint, has now practically no existence, a new and improved process of purification having been adopted. Any disagreeable odors which may hereafter be noticed arising from the spent lime must be ascribed to a want of care in working by the new method.

Second.—That the other offensive appearances and odors incident to the manufacture of gas, referred to in the fourth prayer of the bill of complaint, not being absolutely preventable, can only be reduced to a minimum, and that this minimum is actually reached at the Market Street works. The further question, whether this lower limit being reached, their still exists a nuisance, is a question of fact, to be established only by testimony. It is, therefore, a subject which the commission has not believed within its province.

Third.—That should it be proved by sufficient evidence that the unpreventable odors and appearances observable in the vicinity of these works constitute a veritable nuisance, the only means of entirely abating it would be to grant the fifth prayer of the complainants' bill, and to restrain the defendants from manufacturing gas on the premises. The construction of an elevated stack or tower, in connection with the retort-house, would mitigate the evils only partially, and this at an expense quite disproportionate to the result actually attained, especially if the alteration in the works necessary to ensure the passage of the escaping smoke, steam and gas into such a stack be taken into the account. But if gas be had for lighting, it must be prepared somewhere, and this even with all the nuisance which that preparation necessarily involves. Hence, to order a removal of the Market Street works is simply to abate the nuisance in this locality by transferring it to another. Of the desirability of such an abatement the commission is by no means assured. Moreover, this question includes many considerations other than those now before us. To consider the advantages and disadvantages involved in these considerations, to balance them one against the other, and to determine the preponderating side, are, obviously, purely judicial prerogatives, to be assumed in the present case only by the honorable court itself.

Respectfully submitted.
George F. Barker,
F. A. Genth,
Thomas R. Brown.

Philadelphia, May 1st, 1877.

In Relation to the Working of Gas Retorts by Mechanical Means.

[A Paper read before the "Society of Gas-Lighting," by Charles C. Mowton, Esq., Engineer of the New York Gas-light Company.]

Of the various problems which continually present themselves to the attention of the engineer who is interested in improving the known, and developing the unknown, means of more economically producing illuminating gas, by the distillation of coal, none appear to be surrounded with more difficulties, or require more patient research for the discovery of "means to accomplish ends," than that of substituting steam power, or its equivalent, for manual labor in the working of the retorts.

The subject is no new one to the minds of the gas fraternity; its successful accomplishment being a boon long sought for, and believed by them to be, when practically demonstrated and introduced to general use, the desired panacea which will ameliorate, in a measure, the evils incident to the practice now in vogue, and which entail upon the gas company the expense, and upon the engineer the management, of large numbers of men who, in times of an unsettled labor market, have it in their power to cause considerable trouble.

Various methods have been devised for the accomplishment of the object in question, and many engineers of England and the Continent have applied their best energies to the study of the subject and, while several ingenious and apparently feasible machines have been devised in that quarter, none of the productions seem as yet to have commanded public attention, or have produced the results in actual practice which are necessary to ensure their taking rank as important and permanent adjuncts to the plant of retort houses.

The conditions which it would seem should obtain, in any mechanism for the purpose under consideration, are of a threefold character; that is to say, there should not only be the ability to put the coal into the retort, and to withdraw the coke (the two functions which, as yet, are those only which have attracted the attention of engineers upon the other side of the Atlantic) but there should exist the ability to separate the coal into given quantities, at the will of the operator of the mechanism, so that a retort may be charged with a specified weight, and its neighbor with the same, or a greater or less amount, as circumstances may require.

It is of the utmost importance that the coal should be evenly laid upon the floor of the retort, thereby ensuring an even penetration of heat to the mass. This cannot be accomplished by the revolving scoop, a device which is used by the "Best and Holden machine," the "Foulis apparatus," and in all other attempts at power charging prior to the discovery of the method patented by Mr. Rowland some five years since.

At the present time there is a "Power Retort Worker," operating ten benches, of six retorts each, at the works of the New York Gas-light Company. It is the invention of, and constructed by, Mr. Thos. F. Rowland, of New York, and is daily proving its ability to perform the labor for which it was intended much better, and more economically, than the same can be manually accomplished.

It is capable of being, and often is, worked at the rate of drawing and charging twenty retorts in as many minutes, cleaning them perfectly and depositing the coal evenly therein. Its ability to automatically divide the coal into equal, or unequal, quantities, at the will of the operator, is remarkable, and of such precise character that, when set for a given quantity of coal per retort, and the receptacle of the apparatus loaded with the aggregate coal for, say, twenty retorts, the receptacle will be emptied when the last retort is charged, and each individual retort will have received its proper quota, and this without any attention from the operator whatever. The ability to unequally divide the charges is such that one retort may receive, say, 300 lbs. of coal, and the next one 150 lbs,, or any number of pounds intermediate to the two sums, by simply turning an index wheel, which can be accomplished in 20 seconds.

The apparatus is so designed that it will command the retorts, regardless of any irregularity in the system of the setting, although it is preferable that they should be equally spaced, to ensure the rapid working of the machine.

The apparatus is, briefly, a locomoting carriage, travelling by preference upon an elevated rail, although it would be equally as effective on a surface rail, the former being adopted in order to keep a floor space for the coke buggies, as in the case of the New York Gas Works. Its functions are to travel the length of the retort house, automatically divide the coal into specified quantities, putting the same into the retorts, and delivering the coke into the wagons.

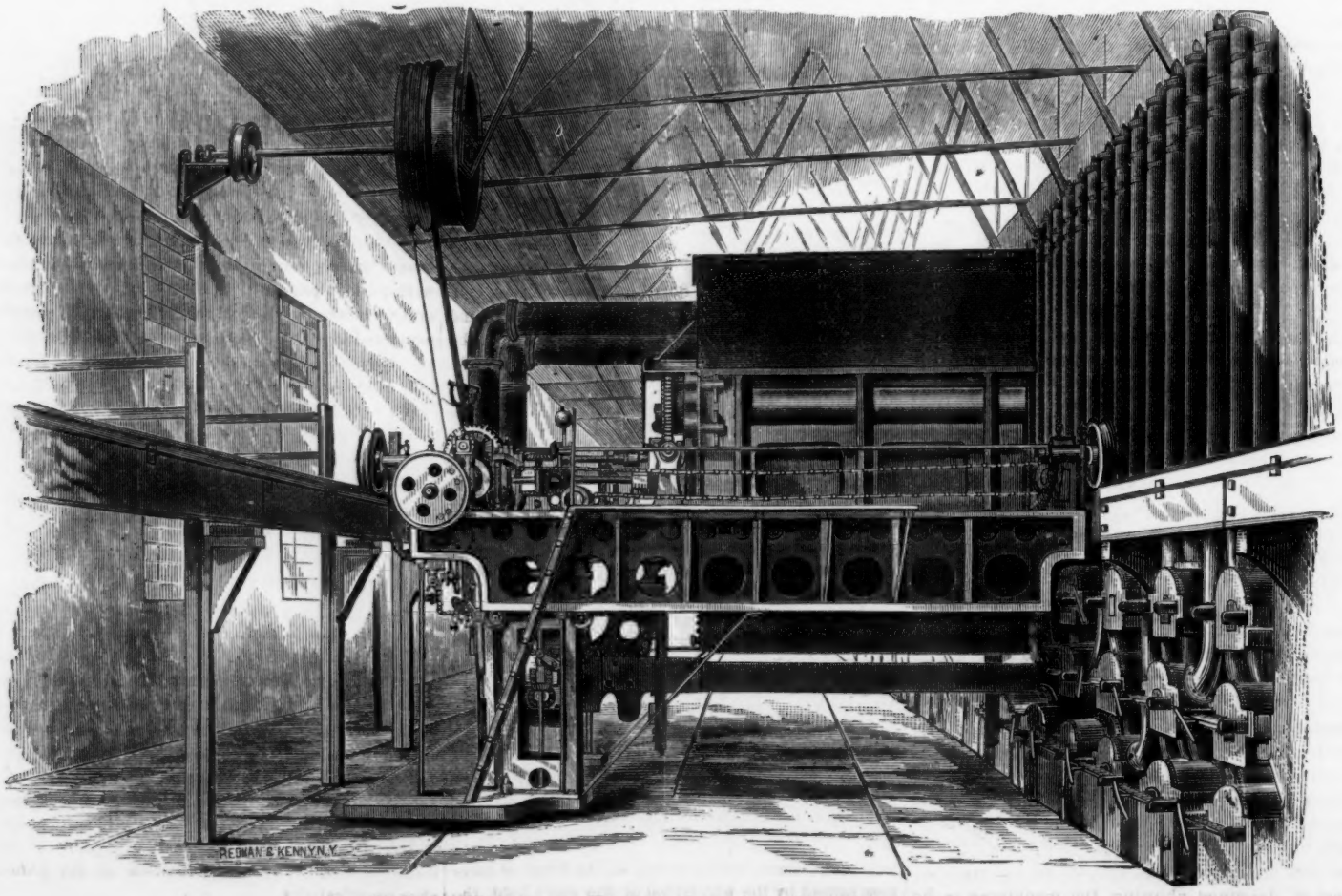
The scheme also contemplates the automatic receiving of the coal from the storehouses; sizing it to cubes not exceeding a given dimension; weighing it in bulk and depositing into the hopper or receptacle of the charging machine, without delaying the work of the machine; but this latter portion of the invention has not been introduced at the New York Gas Works.

The power to perform the various functions is conveyed by means of compressed air, which has proved itself a valuable agent, as it performs the triple duty of functioning the machine, creating ventilation by the exhaust, and tending to keep the operators cool, and last, though not least, affording a means of preventing the rake and handle of the drawing portion of the apparatus from becoming hot and melting, which end is obtained by causing the air to pass through the handle and hoe, thus carrying off the heat and obviating what at first threatened to be a serious drawback to success—*i. e.*, the constant and rapid destruction of the rake or hoe, and the handle to which it is attached. As an illustration of the value of this device to prevent the rake and its handle from heating, it is well to state that previous to its adoption those portions would be burnt out every day, whereas the machine with the air circulating through the rake has run for four or five weeks, and, as yet, there is no sensible depreciation in the strength, or change in the shape of the parts which come in contact with incandescent coke.

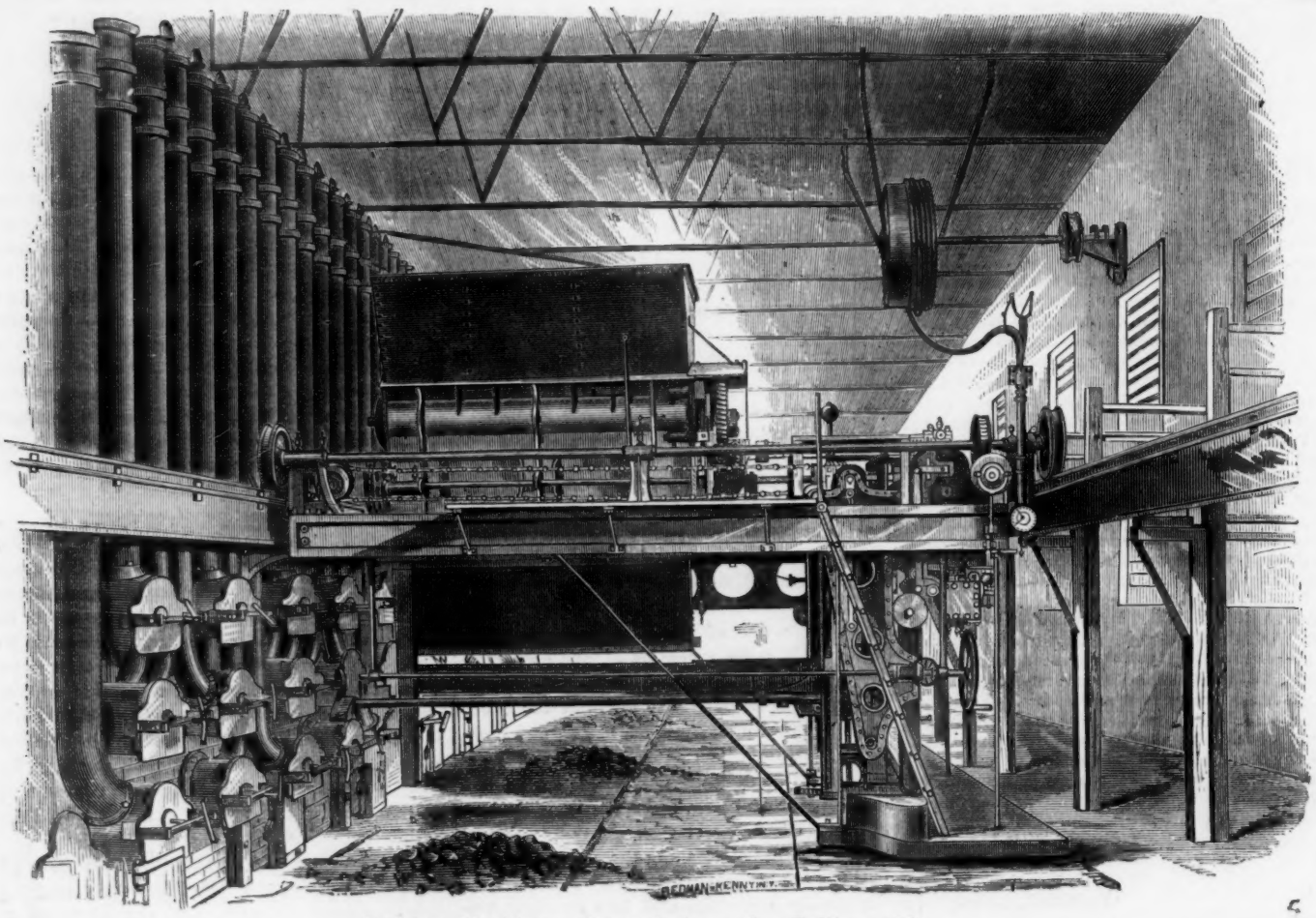
Regarding the question of economy, it is but fair to state that the machine, as now being used, is not a true exponent of its value; the scheme being new, and consequently undeveloped, it was considered expedient to test it as to its power to perform the functions claimed for it, and also to settle the question of wear and tear, rather than to put it upon its economical test before the other factors were ascertained. It was thought that this object could be attained by working it upon ten benches of sixes (60 retorts) notwithstanding its capacity is equal to two and a-half times that number, and working upon which it would develop the most economical duty.

The test as made, *i. e.*, working ten benches of sixes, which it has now been doing for something over four months, drawing and charging in that time about 35,000 retorts, has proven its ability

INTERIOR VIEWS OF RETORT-HOUSE OF THE NEW YORK GAS-LIGHT COMPANY.



Stoking Machinery Viewed from the Charging Side.



Stoking Machinery Viewed from the Raking Side.

to do all that its founder anticipated, while the wear and tear of the machine proper has been much less than its most sanguine advocates had believed, and stated, would result. From the data now obtained it is believed, by those competent to judge, that the subject of wear and tear in machines of the character of the one in question has been overrated, and that, when they have become a permanent institution in our retort houses, it will be found that the expense incurred in keeping the apparatus up to its proper standard will not exceed that now expended in repairing the scoops, shovels, rakes, etc., incident to the present method of operating.

The inventor states that the apparatus is capable of saving from 30 to 40 per centum of the wages expended in a retort house manufacturing over one million cubic feet of gas per day; and that a further advantage obtains, by reason of a greater yield of gas from the coal (which, he says, is from six to eight per centum of the entire quantity) primarily consequent upon the evenness with which the coal is deposited upon the floor of the retort, and secondarily, from the rapidity of the charges and the regularity of their capacity.

These points remain to be proven, but it is patent, from the experience obtained at the works of the New York Gas-light Company, that a gain of at least twenty-five per centum, over the old method of working, may be effected by substituting machinery of the character in question, and working the same at its economic capacity. Mr. Rowland has designed his invention with reference to their adoption by the gas companies of the larger cities of England and the Continent, and, in response to invitations from gentlemen in London interested in the subject, he has executed a set of drawings showing the machinery as he would propose to construct it for works of the magnitude of those at Beckton.

In this case he proposes to make the drawing independent of the charging apparatus, each function being performed by a separate machine, having its own engine, and capable of locomoting distinct from the other. Experience has demonstrated that the function of charging can be performed in one-third the time required for withdrawing the coke; he therefore proposes to supply the drawing machine with three sets of raking gear, each set under the control of an operator.

The machine travelling along the house will be drawing three retorts at once, or at the rate, say, of 90 or 100 retorts per hour, while the charger, following after, will divide the coal and charge the retorts, with equal facility, under the guidance of another operator.

Thus, two sets of this machinery (one on each side of the range of benches) will work the entire house, or, say, 600 retorts.

Mr. Rowland says the number of men required for the whole operation, that is to say, from the time the coal is started on its travel from the coal store (which, in the case of the Beckton retort house, consists of wings adjoining or forming part of the house, and are parallel to the benches) until it arrives at coke, and is deposited in the wagons beneath the stage, will not exceed fifty, (per twenty-four hours working of the house) or an average of, say, one man to every 40,000 feet of gas produced, assuming the house to be capable of producing, when worked at its full capacity, three million cubic feet of gas, and that two-thirds of that amount is its fair average daily production.

Of course the opinions herein stated are more or less based upon theoretical deductions, and time will necessarily elapse before the predicted results give place to ascertained facts.

It is the intention of Mr. Rowland to pursue the subject until he has exhausted it, and demonstrated, both here and abroad, that all obstacles to the permanent substitution of steam power, or its equivalent, for manual labor in working retorts, are removed, and that the transition has become an accomplished fact, or otherwise prove the obstacles to be insurmountable, and that he, at least, is unable to master the subject.

Report of the Department of Public Works for the Quarter Ending December 31, 1876, Bureau of Lamps and Gas.

DEPARTMENT OF PUBLIC WORKS,
BUREAU OF LAMPS AND GAS,
NEW YORK, January 4, 1877.

Hon. Allan Campbell, Commissioner of Public Works:

[Concluded from page 231.]

EXHIBIT "R."

CONTRACT OF THE SUBURBAN GAS-LIGHT COMPANY.

This agreement, made the fifth day of November, A. D. 1870, between the Board of Town Officers, consisting of the Supervisors, Justices of the Peace, and Town Clerk of the Town of West Farms, in the County of Westchester, of the first part, and the Suburban Gas-light Company of the second part:

Witnesseth, That the said party of the second part, for and in consideration of the money herein agreed to be paid and of the security guaranteed by this contract, covenants and agrees to construct on the Bronx river, in the town of West Farms, a complete works and apparatus for the manufacture of coal gas, and to lay mains for the distribution of the said gas through and in such graded and regulated streets and highways of said town as the said party of the first part may order to be lighted with public lamps, and to light with a good quality of coal gas all the street lamps now erected or which shall be hereafter erected by said party of the first part in any lamp district established in said town of West Farms, or which shall be hereafter established therein, and to furnish the said gas, light and extinguish the said lamps and keep the lanterns clean, until the expiration of the term of ten years from the first day of January next hereafter; the burners of said lamps to be neither more nor less than three feet burners, and the same to be and remain lighted during all the hours of darkness caused by the withdrawal of the sun's light, the time of lighting and extinguishing to be as set down in the annexed table; and in consideration thereof, and of the benefits to the property of the town that will arise by reason of having therein a supply of gas for lighting public and private buildings, and as an inducement to said party of the second part to make the expenditure necessary for the erection of said manufactory and laying said mains, the said party of the first part promises and agrees to pay said party of the second part for the period of ten (10) years from the first day of January, 1871, at the rate of fifty dollars per year for each and every lamp lighted as aforesaid, such payment to be made out of the money to be assessed and collected as provided by chapter 572 of the Laws of 1870.

And it is understood and agreed that the party of the second part shall make all necessary repairs to the posts, lanterns, and connecting-pipes of said lamps, during said ten (10) years, at the expense of said party of the first part, charging therefor the cost price of such repairs: and that such price shall be paid by said party of the first part out of the moneys assessed and collected as aforesaid.

And it is further understood and agreed by and between the aforesaid contracting parties, to wit:

The Town Officers of the town of West Farms, in the County of Westchester, and the Suburban gas-light company, that this, the above-written contract, shall remain binding and in full force for the period of ten (10) years, from the first day of January next, hereafter, as aforesaid.

In witness whereof, the said Town Officers have hereunto, severally and officially, set their hands, and the said party of the second part hath hereunto caused its corporate seal to be affixed, and the same to be subscribed by its president and secretary.

F. Grote, Supervisor.
F. Meyer, Town Clerk.
P. R. Denham, W. G. Lent, S M. Purdy, D. R. Shiel } Justices of the peace.
Chas. W. Bathgate, President.
[L. S.] Silas D. Gifford, Secretary.

EXHIBIT "S."

FORM OF CONTRACT FOR THE YEAR 1877.

Agreement.

This agreement, made, entered into, and concluded this , in the year one thousand eight hundred and seventy-seven, by and between the Mayor, Aldermen and Commonalty of the City of New York, by the Commissioner of Public Works, acting in conjunction with the Mayor and Comptroller, parties of the first part, and of said city, parties of the second part:

Witnesseth, that the said parties of the second part hereto have agreed and by these presents do agree with the said parties of the first part, for the consideration hereinafter mentioned, and under the penalty expressed in a bond bearing even date with these presents and hereunto annexed, to furnish the gas for the lamps, and to light, extinguish, clean, repair, and reglaze the lanterns, replace the cocks, tubes, and burners, crossheads, lamp irons, and lanterns, repair the lamp posts, and paint the lamp posts and lanterns, and to fit up and light such new lamps as may be required by the parties of the first part in such portions of the city of New York mentioned and described as follows, to wit:

for the term of commencing , one thousand eight hundred and seventy-seven, and ending , in the same year (1877).

And it is further agreed that the said parties of the first part shall have the right to order the pipes or gas mains of the parties of the second part to be extended in and along all the streets, avennes, and public places within the limits aforesaid or adjacent thereto.

All the gas and materials furnished and all the work and labor done by the parties of the second part hereto, shall be of the kinds and qualities and furnished and done in all respects in strict conformity to the terms, conditions, and requirements of the herein after specifications.

If the proposal of the parties hereto of the second part included any lamps with which the pipes or mains of said parties of the second part were not connected at the time of the making of its bid, thirty days from the date of the execution of this agreement, and such further time, not exceeding thirty days, as may be deemed reasonable by the Commissioner of Public Works, will be allowed the parties of the second part in which to connect such pipes or mains with such lamps. Provided, the parties of the second part have a grant or franchise from the Mayor, Aldermen and Commonalty, authorizing the laying of gas mains in the streets or parts of streets in which the said lamps are located.

But no payment on account of any such lamps will be made to the parties of the second part for the time so allowed, nor until the same shall have been connected with the mains of the parties of the second part, nor will payment be made on account of any lamp except for the time during which all the requirements herein mentioned shall have been fully performed in accordance with the following

SPECIFICATIONS.

Lighting.—The lamps shall be lighted during such times as the public lamps throughout the City of New York may be required to be lighted, by the regulations of the said parties of the first part, in accordance with a time table, to be furnished by the Commissioner of Public Works. Also, the Department of Public Works may direct and require, by notice to that effect, that all or any portion of said public lamps shall be lighted, and kept burning, at any other time or times during the continuance of this contract; and the said parties of the second part shall light the same, and continue them burning, in accordance with any and every direction of the Department of Public Works to that effect: provided that, if in compliance with the direction of the Department of Public Works, the whole number of hours during which the said lamps, or a portion of them, are kept burning, shall exceed the average number of hours during which the

EXHIBIT "E."

Time Table for Lighting and Extinguishing the Public Lamps in the City of New York, for the Year 1877, Showing the Number of Hours Burning Each Night and Month of the Year, and the Total Number for the Whole Year.

Date.	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			JUNE.			JULY.			AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.			DECEMBER.		
	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.	Light.	Extinguish.	Time burning.
	H.M	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.	H.M.	H.M.	H. M.
1	4.45	6.20	13.35	5.15	6.15	13.00	6.00	5.30	11.30	6.30	5.00	10.30	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.25	3.30	8.05	6.45	4.15	9.30	5.45	4.45	11.00	5.00	5.15	12.15	4.35	6.00	13.25
2	4.45	6.20	13.35	5.15	6.15	13.00	6.00	5.30	11.30	6.30	4.45	10.15	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.25	3.30	8.05	6.45	4.15	9.30	5.45	4.45	11.00	5.00	5.15	12.15	4.35	6.00	13.25
3	4.45	6.20	13.35	5.15	6.15	13.00	6.00	5.30	11.30	6.30	4.45	10.15	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.25	3.30	8.05	6.30	4.15	9.45	5.45	4.45	11.00	5.00	5.15	12.15	4.35	6.00	13.25
4	4.45	6.20	13.35	5.15	6.15	13.00	6.00	5.30	11.30	6.30	4.45	10.15	7.00	4.00	9.00	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.30	8.05	6.30	4.15	9.45	5.45	4.45	11.00	5.00	5.15	12.15	4.35	6.00	13.25
5	4.45	6.20	13.35	5.30	6.00	12.30	6.00	5.30	11.30	6.30	4.45	10.15	7.00	4.00	9.00	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.30	8.05	6.30	4.15	9.45	5.45	4.45	11.00	5.00	5.30	12.30	4.35	6.00	13.25
6	4.45	6.20	13.35	5.30	6.00	12.30	6.00	5.30	11.30	6.30	4.45	10.15	7.00	4.00	9.00	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.30	4.15	9.45	5.45	4.45	11.00	5.00	5.30	12.30	4.35	6.00	13.25
7	4.45	6.20	13.35	5.30	6.00	12.30	6.00	5.30	11.30	6.30	4.45	10.15	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.30	4.15	9.45	5.45	4.45	11.00	5.00	5.30	12.30	4.35	6.00	13.25
8	5.00	6.20	13.20	5.30	6.00	12.30	6.00	5.30	11.30	6.30	4.45	10.15	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.30	4.15	9.45	5.40	5.00	11.20	5.00	5.30	12.30	4.35	6.00	13.25
9	5.00	6.20	13.20	5.30	6.00	12.30	6.00	5.30	11.30	6.40	4.20	9.40	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.30	4.15	9.45	5.40	5.00	11.20	5.00	5.30	12.30	4.35	6.00	13.25
10	5.00	6.20	13.20	5.30	6.00	12.30	6.00	5.30	11.30	6.40	4.20	9.40	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.20	4.30	10.10	5.40	5.00	11.20	5.00	5.30	12.30	4.35	6.00	13.25
11	5.00	6.20	13.20	5.30	6.00	12.30	6.00	5.30	11.30	6.40	4.20	9.40	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.20	4.30	10.10	5.40	5.00	11.20	5.00	5.30	12.30	4.35	6.00	13.25
12	5.00	6.20	13.20	5.40	5.45	12.05	6.15	5.15	11.00	6.40	4.20	9.40	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.25	3.40	8.15	6.20	4.30	10.10	5.40	5.00	11.20	4.45	5.45	13.00	4.35	6.00	13.25
13	5.00	6.20	13.20	5.40	5.45	12.05	6.15	5.15	11.00	6.40	4.20	9.40	7.15	3.30	8.15	7.40	3.15	7.35	7.45	3.15	7.30	7.10	3.50	8.40	6.20	4.30	10.10	5.40	5.00	11.20	4.45	5.45	13.00	4.35	6.00	13.25
14	5.00	6.20	13.20	5.40	5.45	12.05	6.15	5.15	11.00	6.40	4.20	9.40	7.20	3.30	8.10	7.40	3.15	7.35	7.45	3.15	7.30	7.10	3.50	8.40	6.20	4.30	10.10	5.40	5.00	11.20	4.45	5.45	13.00	4.35	6.00	13.25
15	5.00	6.20	13.20	5.40	5.45	12.05	6.15	5.15	11.00	6.40	4.20	9.40	7.20	3.30	8.10	7.40	3.15	7.35	7.45	3.15	7.30	7.10	3.50	8.40	6.20	4.30	10.10	5.30	5.00	11.30	4.45	5.45	13.00	4.35	6.00	13.25
16	5.00	6.20	13.20	5.40	5.45	12.05	6.15	5.15	11.00	6.45	4.15	9.30	7.20	3.30	8.10	7.40	3.15	7.35	7.40	3.15	7.35	7.10	3.50	8.40	6.20	4.30	10.10	5.30	5.00	11.30	4.45	5.45	13.00	4.35	6.00	13.25
17	5.00	6.20	13 20	5.40	5.45	12.05	6.15	5.15	11.00	6.45	4.15	9.30	7.20	3.30	8.10	7.40	3.15	7.35	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.30	5.00	11.30	4.45	5.45	13.00	4.35	6.00	13.25
18	5.00	6.20	13.20	5.40	5.45	12.05	6.15	5.15	11.00	6.45	4.15	9.30	7.20	3.30	8.10	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.30	5.00	11.30	4.45	5.45	13.00	4.35	6.00	13.25
19	5.00	6.20	13.20	5.45	5.40	11.55	6.15	5.00	10.45	6.45	4.15	9.30	7.20	3.30	8.10	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.30	5.00	11.30	4.40	5.45	13.05	4.35	6.00	13.25
20	5.00	6.20	13.20	5.45	5.40	11.55	6.15	5.00	10.45	6.45	4.15	9.30	7.20	3.30	8.10	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.30	5.00	11.30	4.40	5.45	13.05	4.35	6.00	13.25
21	5.00	6.20	13.20	5.45	5.40	11.55	6.15	5.00	10.45	6.45	4.15	9.30	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.30	5.00	11.30	4.40	5.45	13.05	4.35	6.00	13.25
22	5.15	6.15	13.00	5.45	5.40	11.55	6.15	5.00	10.45	6.45	4.15	9.30	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.15	5.15	12.00	4.40	5.45	13.05	4.35	6.00	13.25
23	5.15	6.15	13.00	5.45	5.40	11.55	6.15	5.00	10.45	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.15	4.30	10.15	5.15	5.15	12.00	4.40	5.45	13.05	4.35	6.00	13.25
24	5.15	6.15	13.00	5.45	5.40	11.55	6.15	5.00	10.45	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.00	4.45	10.45	5.15	5.15	12.00	4.40	5.45	13.05	4.40	6.15	13.35
25	5.15	6.15	13.00	5.45	5.40	11.55	6.15	5.00	10.45	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.00	4.45	10.45	5.15	5.15	12.00	4.40	5.45	13.05	4.40	6.15	13.35
26	5.15	6.15	13.00	6.00	5.30	11.30	6.30	5.00	10.30	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	7.10	3.50	8.40	6.00	4.45	10.45	5.15	5.15	12.00	4.35	6.00	13.25	4.40	6.15	13.35
27	5.15	6.15	13.00	6.00	5.30	11.30	6.30	5.00	10.30	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	6.45	4.15	9.30	6.00	4.45	10.45	5.15	5.15	12.00	4.35	6.00	13.25	4.40	6.15	13.35
28	5.15	6.15	13.00	6.00	5.30	11.30	6.30	5.00	10.30	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	6.45	4.15	9.30	6.00	4.45	10.45	5.15	5.15	12.00	4.35	6.00	13.25	4.40	6.15	13.35
29	5.15	6.15	13.00	.....	.....	.....	6.30	5.00	10.30	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.40	3.15	7.35	6.45	4.15	9.30	6.00	4.45	10.45	5.30	5.15	12.15	4.35	6.00	13.25	4.40	6.15	13.35
30	5.15	6.15	13.00	.....	.....	.....	6.30	5.00	10.30	7.00	4.00	9.00	7.30	3.15	7.45	7.45	3.15	7.30	7.25	3.30	8.05	6.45	4.15	9.30	6.00	4.45	10.45	5.30	5.15	12.15	4.35	6.00	13.25	4.40	6.15	13.35
31	5.15	6.15	:3.00	.....	.....	.....	6.30	5.00	10.30	.....	.....	.....	7.30	3.15	7.45	.....	.....	.....	7.25	3.30	8.05	6.45	4.15	9.30	.....	.....	.....	5.30	5.15	12.15	.....	.....	.....	4.40	6.20	13.40
Totals....			411.45			342.00			341.45			288.25			254.10			226.55			234.50			267.00			305.25			357.35			386.10			417.20

Total for year..... 3,833 hours and 20 minutes.

public lamps throughout the city have been kept burning during the last five years prior to the date of this contract (which the parties hereto estimate to be and fix at 3,833 hours and 20 minutes per annum), then, in that case, the said parties of the second part shall be entitled to claim and receive, for such additional number of hours during which the public lamps, or such portion of them, in the district aforesaid, are kept burning in accordance with such direction of the said Department of Public Works, an additional compensation hereinafter allowed, proportioned to the increased number of hours beyond the said average number. And also, provided that, if at any time, in compliance with the direction of the said Department of Public Works, the number of hours during which the said lamps, or any portion of them, are kept burning, shall be less than the aforesaid number of 3,833 hours and 20 minutes per annum, then, in that case there shall be deducted an amount equivalent to a pro rata decrease below said average number of hours. And also, provided that said Department of Public Works shall have the right at any time to increase or diminish the number of lamps awarded to be lighted by the parties of the second part under this contract. It is expressly agreed that the lamps shall be lighted either by means of a torch or the use of a ladder, and that the lamplighters will not be permitted to climb the lamp post for such purpose. The parties of the second part to keep the service-pipes and stand pipes of said lamps cleared of all obstructions, and in good order, at their own cost and expense, except such service pipes as shall have been broken or removed by the construction of sewers.

Gas, Quality of.—The gas to be of such an illuminating power, by photometrical test, made at a distance of not less than one mile from the place of manufacture, that an Argand burnrr, having fifteen holes and a seven inch chimney, and consuming at the rate of five cubic feet of gas per hour, shall give a light equal to the light of sixteen sperm candles, of six to the pound, and burning at the rate of 120 grains of spermaceti per hour; aud, as regards purity, free, within certain limits not injurious to public health, from ammonia, sulphuretted hydrogen, and other sulphur or noxious compounds.

Burners.—The burners in the public lamps shall be equal to those heretofore used in the City of New York, and shall be of a capacity to burn, and shall burn three cubic feet of such gas per hour during the time they are lighted; under a hydraulic pressure of one inch of water. The same to be kept clear at all times, so as to allow a free flow of gas.

Cleaning.—All the lamps to be kept in a cleanly condition, and they shall be thoroughly cleaned at least twice in each week, and oftener, if the Department of Public Works shall direct or require the same.

Repairing and Reglazing.—The lamps to be reglazed within twenty-four hours after the same shall be broken. The glass and putty for that purpose to be furnished by the parties of the second part, without cost to the city. The lanterns to be kept in repair by the parties of the second part, at their own cost and expense.

Repairing Lamp-Posts.—All lamp-posts which the Department of Public Works require to be straightened, or their columns to be reloaded, or to be repaired in any other manner, shall be so straightened, or columns reloaded, or repaired in any other manner, as herein specified, as may be required, within twenty-four hours after being required by the Department of Works so to do.

Painting.—The lamp-posts and lanterns to be painted by the parties of the second part, with one coat of paint at least once in each year, at their own expense. The work to be done between the first day of May and the first day of November.

Removing Lamp-Posts.—All lamp-posts to be taken down which the Department of Public Works may require to be removed for any purpose.

Cocks, Tubes, and Burners.—The cocks, tubes and burners which may become worn out and useless, or which, in the opinion of the Department of Public Works, are worn out or useless, to be immediately replaced by the parties of the second part, at their own cost and expense.

Fitting up New Lamps.—New lamps to be fitted up in any street, avenue, or public place wherever the same may be required by the Department of Public Works. The parties of the second part to furnish the necessary conductors of metal to each public lamp that may be required, the service pipe leading from the gas main to the lamp-post, and the stand-pipe of the lamp-post to consist of three-quarter inch wrought iron pipe. Bracket-lamps to be fitted up, in lieu of lamp-posts, when required, the stand-pipe of the lamp to be fastened to the wall in a firm and secure manner. The parties of the second part to make all the necessary connections from the gas mains to the lamp, and to fit up and paint all new lamp-posts or brackets, and supply with gas and light the lamps as aforesaid. It is agreed, however, that the lamp-posts, lanterns, lamp irons, and brackets shall be furnished by the parties of the first part, through the Department of Public Works, to the parties of the second part.

Lanterns.—All lanterns which, in the opinion of the Department of Public Works, may become worn out or useless, are to be replaced on the posts by the parties of the second part without charge to the city. The lanterns for that purpose are to be furnished by the parties of the first part, through the Department of Public Works, to the said parties of the second part.

Crossheads and Lamp-Irons.—The cross-heads and lamp-irons which, in the opinion of the Department of Public Works, may become broken or out of order are to be replaced on the posts by the parties of the second part without charge to the city. The cross heads and lamp-irons for that purpose are to be furnished by the parties of the first part, through the Department of Public Works, to the said parties of the second part.

Street Signs.—The glass street signs to be retained in their proper places and positions in the lantern. The signs to be furnished and placed in the lantern by the Department of Public Works.

Cartages.—All supplies which, under this agreement, may be furnished by the parties of the first part, will be so furnished, but the cartage thereof shall be done by the parties of the second part.

The prices fixed for the various services herein provided to be performed by the parties of the second part are as follows:

For furnishing the gas (of not less than sixteen candle power) for each lamp, including the lighting, extinguishing, cleaning, repairing, reglazing, painting, replacing cocks, tubes, burners, crossheads, lamp-irons, and lanterns thereto, for the aforementioned period of , ending 1877,

The sum of.....$

For each lamp post straightened the sum of

" column reloaded the sum of.....

" " refitted the sum of.....

" lamp post removed the sum of....

" lamp post reset the sum of.....

" each new lamp fitted up the sum of

United States Revenue Tax.—And it is hereby agreed by and between the parties to these presents, that the parties of the first part shall not be called upon to pay to the said parties of the second part any amount for any tax which the Government of the United States may assess upon the gas consumed by the public lamps within the district aforesaid.

And it is further agreed that the said parties of the second part shall have the right to lay pipes at any time upon giving 48 hours' written notice to the Department of Public Works of their intention to break up or open any street, avenue, or public place, or part thereof, or to remove any part of the pavement thereof, for the purpose of laying or repairing the pipes, to conduct the said gas; and the parties of the second part shall, whenever they shall break up or open any street, avenue, or public place, replace the earth which they may remove in so doing before sunset of the day on which such opening shall be made (the earth to be thoroughly tamped as the same is thrown into the trench or excavation), and to replace the pavement, and repair the same, in such reasonable time and manner as the Department of Public Works may direct, and in as good and firm a manner as such street, avenue or public place, or parts thereof, were in before being broken up for the purpose aforesaid, and shall, from time to time, as required by the Department of Public Works, readjust and fill and finish the same as long as in the opinion of the Department of Public Works may be necessary on account of the settling of the earth or pavement caused by the opening. Also, that all such repairs as shall at any time become necessary to said pavement by reason of laying the said pipe or conductors, shall be made and done by said parties of the second part, at their own cost and expense. Also, that no such street, avenue or public place, or part thereof, shall be so broken up or opened, or the pavement thereof removed, or shall be again filled up or repaired, except under the direction and supervision of a competent person, to be appointed by the Department of Public Works; but the said parties of the second part shall not be called upon to pay any sum, to any party or parties, for the inspection of any pavement which they may have occasion to replace. And it is further agreed that the said parties of the second part shall and will so conduct the manufacture, or manufactories, as not to create a nuisance, and they will in all things be governed by such reasonable rules and regulations as the said Department of Public Works may from time to time establish or direct, relative to the opening of such streets, avenues, or public places, or parts thereof, and laying down the pipes and conductors, and for lighting, cleaning and protecting the lamps and street signs aforesaid. And it is hereby expressly provided, that nothing herein contained shall be construed or deemed as granting to the said parties of the second part any sole or exclusive right or privilege, or as preventing the said parties of the first part from granting the like privileges as are hereby given to the said parties of the second part, to any other company, persons, or parties whatsoever, or as preventing any persons residing in, or adjacent, or near to any of the said streets, avenues, or public places, or parts thereof, from erecting in or upon his or their own premises, any building or apparatus, to light with gas, his or their own house, store, or manufactory, or premises.

And it is hereby further agreed, that in case the said parties hereto of the second part shall fail or neglect to keep the covenants herein contained, or any of them, or neglect to light, repair, paint, clean or or fit up the public lamps, as before mentioned, or any of them, that it may be lawful for the Commissioner of Public Works to cause such work to be performed by other parties, and to deduct the expense thereof from any moneys which may be due to the parties of the second part, and to hold the parties of the second part and their sureties liable for the amount thereof, which may be in excess of the prices stipulated in this agreement.

And it is further provided, and these presents are upon the express condition, that if the said parties of the second part, or their successors, shall not well and truly observe, perform, fulfill, and keep all and singular the covenants and conditions hereinbefore mentioned and contained, on their part and behalf, to be performed, observed, fulfilled, and kept, according to the true intent and meaning of these presents, then, and in that case, it shall and may be lawful for the Commissioner of Public Works, on the part of the said party of the first part, to annul and vacate this contract, and thereupon it shall become null and void.

And it is further agreed, that on or after the first day of each and every month following the date of this contract, the parties of the second part shall furnish proof to the satisfaction of the Commissioner of Public Works, that they have fully performed and fulfilled this contract in all the particulars and conditions

aforesaid, during the preceding month, and particularly that they have furnished gas of the quality hereinbefore specified; upon so doing, the Commissioner shall certify the fact, and in his certificate state the amount to which the parties of the second part shall be entitled for all the duties performed by them during such preceding month, and annex thereto a requisition upon the Comptroller to pay the parties of the second part therefor the sum to which they shall be so entitled; and without such proof to the satisfaction of the Commissioner of Public Works, he shall not make any certificate nor requisition on the Comptroller; and the parties of the second part shall also furnish proof to the satisfaction of the Comptroller that they have fully performed and fulfilled this contract in all the particulars and conditions aforesaid, and without such proof the said parties of second part shall not be or become entitled to any payment in respect to services which were required to be done, or should have been done, in such preceding month. On the requisitions above provided being presented to the Comptroller of the City, he shall, within twenty days, pay to the parties of the second part the amount thereof in lawful money.

And it is hereby expressly agreed and understood by and between the parties hereto, that the said parties of the first part, their successors and assigns, shall not, nor shall any department or officer of the City of New York be precluded or estopped by any return or certificate, made or given by any Engineer, Inspector, or other officer, agent, or appointee of said Department of Public Works, or said parties of the first part, under or in pursuance of anything in this agreement contained, from at any time showing the true and correct amount and character of the work which shall have been done, and materials which shall have been furnished by the said parties of the second part, or any other person or persons under this agreement.

And the parties hereto declare that this contract is made with reference to the proposals hereto annexed-which are to be taken as part and parcel of these presents.

In witness whereof, the said Commissioner of Public Works, in conjunction with the Mayor and Comptroller have hereunto set their hands and seals, on behalf of the said parties of the first part, and the said parties of the second part have also set their hands and seals, and said parties hereto have executed triplicate copies hereof, one of which is to remain with the Commissioner of Public Works, one other to be filed with the Comptroller of the City of New York, and the third to be delivered to the said parties of the second part, the day and date herein first above written.

Witness:

Commissioner of Public Works [L. S.]
Mayor of the City of New York. [L. S.]
Comptroller of the City of New York [L. S.]
President of———Gas Company [L. S.]
[Seal of Gas Company.]

A New and Easy Method for the Determination of all the Sulphur in Illuminating Gas.

BY T. O'CONOR SLOANE, A.M., E.M.

[Read before the N. Y. Academy of Sciences, March 5, 1877.]

Many methods for the determination of sulphur in illuminating gas have been proposed. Two only are in general use—"Letheby's," and the "Referees'" sulphur tests. In both of these the gas is burned and the products of combustion brought into contact with ammoniacal gas. This condenses the sulphur dioxide and sulphuric acid formed in the combustion. The solution is washed out of the apparatus, and the sulphur which it contains determined. The efficacy of these methods depends upon the complete oxidation of the sulphur in the process of burning. No attempt is made in either to purify the air. Hence the operation has to be conducted in a room in which there is no coal fire, and in which no gas is burning. Even then the air may contain sulphur, as sulphur dioxide, or sulphuretted hydrogen; and this is most to be feared in the vicinity of factories, or in large cities, precisely the places in which these determinations have to be made. Then, in the case of the Letheby apparatus, the flame is liable to be extinguished by draughts. I have never used the Referees' apparatus, but should imagine that it was to some extent open to the same objection.

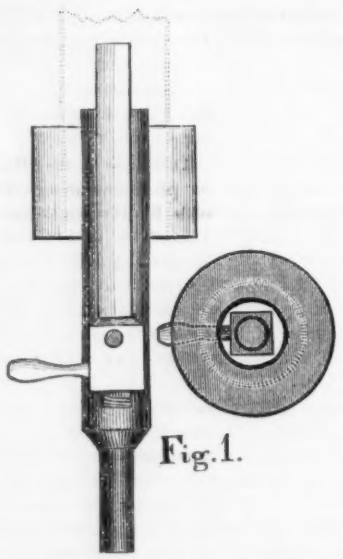


Fig. 1.

I am of opinion that the most practicable method of determining all the sulphur contained in gas is by combustion. This being admitted, the following requirements are essential:

1st. All of the sulphur in the gas, and no more, must be collected; hence,

2nd. The air must be purified from any sulphur which it may contain.

3rd. The apparatus should be simple, and require for its construction no special forms of glass.

4th. The flame should be protected so that it will not be seriously affected by draughts, such as may be caused by opening or shutting doors, close to the burner.

5th. No aspirator should be employed.

In the apparatus here described all these points are met.

The gas is burned in a Bunsen burner, arranged as shown in Fig. 1. The foot is unscrewed, and a tube of about 16 m.m. internal diameter is soldered around it, leaving an annular opening. This tube rises to within 25 m.m. of the top of the burner, and descends 75 m.m. below its bottom. Before fastening it in position all of the air-holes of the Bunsen burner, except one, must be soldered up. This should be one-half closed. The air-tube has then a cup fastened around it, making a second annular space, only, in this case, a closed one. It should be 50 m.m. deep and 50 m.m. wide. Its top should be a little lower than the top of the air-tube. If the cup be filled with water, the burner lit, and a chimney placed over it resting in the cup, all the air consumed by the burner must rise through the air-tube. Below the burner it may conveniently be reduced to one half the diameter given. I also advise that the air-tube be made to unscrew, just above the burner nipple. Then the supply of air to the interior of the burner can always be regulated, by partly closing the one air-hole with sealing wax, or gummed paper.

The air is purified by potassic permanganate. A bottle, tubulated at the bottom, and of six liters capacity, is filled with small marbles, or broken glass, or a mixture of both, and a solution of permanganate spread all through it. Its upper neck is supplied with a perforated cork, which receives tightly the air-tube of the burner. Thus the bottle supports the burner and acts as air-purifier. It will be seen that all the air which passes through the air-tube must first pass through the glass and marbles.

The products of combustion rise from the burner, through a chimney-tube, into suitable receiving and condensing apparatus. The whole arrangement is shown in Fig. 2.

The chimney-tube must be of thin glass, and no over 32 m.m. in diameter; 25 m.m. is a good size. The sides must be straight, and it may be 380 m.m. to 420 m.m. long. A tube of 14 m.m. to 17 m.m. in diameter, bent exactly as indicated, is fitted into its upper end with a perforated cork. The heat is rather hard on the cork, so the best quality should be employed. This tube passes into the tubulated bottle A. The bend must be smooth, and the tube must slope down from this bend into the bottle. Thus, any water which may condense in it will flow away from the burner. If any run back, it might crack the tube or chimney, or put out the burner.

The bottle A is an ordinary tubulated bottle of five or six liters capacity. It rests upon its side, and should be secured in position with some wedges, or weights. One must be selected whose lower neck is of large diameter. The exit-tube is of 13 m.m. internal diameter. It runs forward and to within 30 m.m. of the lower side of the bottle A. Its shape can be seen in the figure. It enters the receiver B. This may be of a liter capacity. I employ a tubulated retort receiver, but any bottle will answer, and a hole in the cork is sufficient to permit the escape of the gas from the combustion. If a flask be employed, no cork will be required. The flask can be fixed in position, so that the tube will reach nearly to its bottom.

By an eduction-tube, of large size, 50 m.m., tin or iron, the fumes may be carried off, if this be desired.

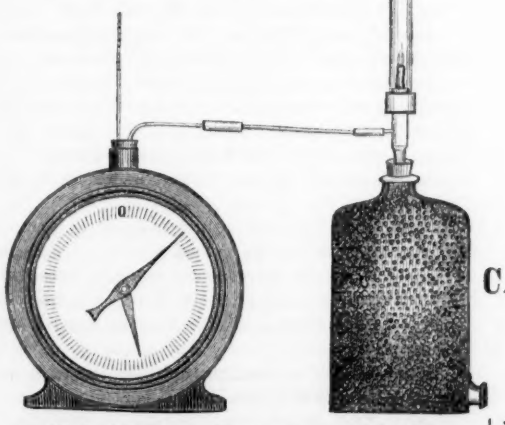
The gas, whose temperature should be noted from time to time, is burned at the rate of 0.8 cubic feet per hour. A solution of potassic permanganate with an excess of hydrochloric acid is contained in the receivers, A and B. The products of combustion pass over this solution, and are acted on by the chlorine, nascent, and evolved; 95 per cent. of the sulphur will be absorbed in A, the remainder in B. I will now give the details of the manipulation, and the minor adjustments.

The meter is put in position, levelled, and the water line adjusted. A good wet meter is a very satisfactory measurer of gas, and is more convenient and portable than a graduated gasholder. Its connection with the gas main should be as short as possible, and all metal or glass. India-rubber connections should be few, and the ends of tubes so connected should be in contact. If the connection with the main be through a long service-pipe, gas should be permitted to escape from it before and during the entire experiment, so as to insure a fresh supply. In a laboratory, the regular burners which are in use will secure this end. The burner is in like manner connected to the outlet of the meter. The gas is now turned on, lighted, and permitted for a while to burn at its full capacity. It may temporarily be supported on a ring stand. This expels all old gas or air from the meter. The purifying bottle is now charged. Ten or fifteen grammes of permanganate are dissolved in about two hundred c.c. of water. The solution is poured into the bottle. Both necks are tightly corked, and the whole is turned over and over in every direction, until the solution is spread all over the surface of the glass and marbles. The bottle is then placed by the meter, the corks removed, and the burner fixed with its cork in the neck.

Two solutions of permanganate must now be made. Each one must contain one gramme of the salt for every two feet of gas which it is proposed to burn in the experiment. This is the minimum. Twice the quantity would not be too much for the receiver A. It should be dissolved in distilled water, about 70 c.c. to the gramme being employed. As an allowance has often to be made for the sulphur contained in the permanganate, it should be weighed out for each experiment, not guessed at. These two solutions are now poured, each into one of the receivers. For each gramme of permanganate 2 c.c. concentrated hydrochloric acid is added, and the whole slightly shaken. The tubes are now put in position. The chimney, for the present, passes down by the side of the burner. Its position is adjusted by moving it up and

down on the tube *a*, so that when it rests on the bottom of the burner cup, the far end of the tube *a* will be 13 m.m. above the surface of the liquid. The near end of this tube should descend some distance, 10–20 m.m., below the cork in the chimney-tube.

The gas-cock is now adjusted so that the gas will pass the meter at less than the ultimate rate. It may afterwards be brought up to nearly a foot, and this rate should not be exceeded. The meter reading is taken, the whole absorption apparatus lifted up quickly, and set down gently, with the chimney-tube over the burner. There will be a slight error in the meter reading, owing to the time required for this operation, but it can be allowed for. The burner cup is



now filled with water. Here care must be taken, or by pouring against the hot chimney-tube it will be cracked. Another precaution is to avoid dipping the end of tube *a*, or *b*, into the solution, or, of course, the flame will be extinguished. The combustion now goes on quietly, and after enough of gas has been burned, one to five cubic feet, it may be turned off, the solutions washed out into a beaker, and the sulphur they contain determined. The solutions, on removal, should still be violet in color.

The easiest way of getting rid of the excess of permanganic acid is to add and heat with a little alcohol. The precipitated brown oxide of manganese dissolves with difficulty, but hard boiling and a large excess of hydrochloric acid will do it. It is well to let it settle, decant the supernatent liquid, and then dissolve the precipitate. It is very slow work to filter it all out, so its solution is to be recommended.

In Fig. 3, I have indicated how a burner can be improvised. The darkly shaded part represents cork—the lightly shaded part plaster of Paris. The chimney-tube for a burner of this description should not exceed 18 m.m. in diameter, and should have an extension of larger diameter as shown, fitted with a perforated cork. The construction is, I think, quite clear. The cup is made of a bottle, wide necked, with the bottom cut off. One small glass tube supplies air to the interior of the burner, the other air holes are closed. Another glass tube supplies external air. The last may be 6 m.m, internal diameter.

There are only two ways in which any sulphur can escape collection in this apparatus. One is insufficient oxidation, the other insufficient condensation.

To investigate the first of these points I employed an apparatus essentially the same, but supplied with air by an aspirator. Thus I could measure pretty closely the relative volume of air to gas, and I found that it made very little difference whether the gas was burned with five or ten times its volume of air. By calculation from analyses it appears that, to completely burn gas, 1.16 to 1.18 parts of oxygen are required, or six parts of air to one of gas.

I here give some of these results; the sulphur I express in percentages, taking the highest result obtained as 100 per cent.

Gas.	A.		B.		C.	
Feet of air to one foot of gas.....	6.6	10.0	5.2	10.2	9.1	5.5
Percentage of sulphur	100.0	98.6	96.8	100.0	100.0	96.5

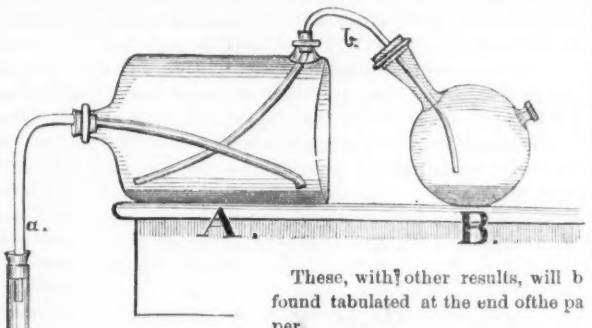


Fig. 2.

These, with other results, will be found tabulated at the end of the paper.

This proves that the sulphur will be perfectly condensed within very wide limits of oxidation. I may observe that one per cent. of sulphur, on the quantity of gas I employed for each experiment, was represented by less than three milligrammes of baric sulphate.

To prove that the condensation was perfect, I performed the following experiments: I made sulphur determinations with the apparatus arranged as shown in the engraving, but in place of the receiver B, I used an ordinary wide-mouthed bottle, which I shall still designate as B.

Per cent. sulphur

	Exp. 1.	Exp. 2.
in A.....	28·26	42·26
" " B...	4.46	2.13

Finally, to try how perfectly the air was freed from sulphur by the purifying bottle C, I passed air over a surface of a strong solution of sulphur dioxide, through the bottle in question, and then through the receiver A containing the acidified solution of permanganate. Air was passed through at the rate of about ten cubic feet per hour, and only a trace of sulphur could be found; this trace I attribute to the permanganate, which contained fifty-three one-thousandths of one per cent.

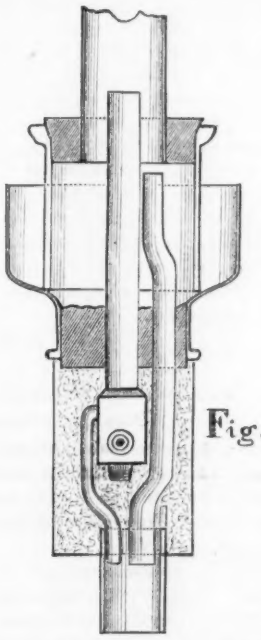


Fig. 3.

Now, the amount of sulphur which coal gas in England may contain under the law is twenty grains per hundred cubic feet. An error of five per cent. would here involve the question of only one grain, and of all the experiments quoted none has so large an error. The average difference is only three per cent. For the "Referees'" apparatus it is claimed that it will show twenty to thirty per cent. more than Letheby's. Compared to this difference, five per cent even seems a small discrepancy. It may be noticed that the highness of the results was indepennent of the amount of air.

The receivers may be placed on a table, and the meter and purifying bottle on the floor. The dimensions given favor such a disposition.

I give below a number of results obtained with a slightly different absorption apparatus. In conducting the experiments leading to them, an aspirator was employed, giving a close approximation to the amount of air consumed.

A.

Date, 1876.	July 10.	July 17.	July 18.	July 20.	July 21.	July 24.	July 26.
Gas, cub. ft. per hour	.60	.70	.77	.50	.59	.70	.55
Rate of air to gas.....	8.25	9.1	5.4	5.8	6.4	7.3	9.4
Cubic ft. gas burned .	1.00	1.00	1.00	1.00	1.66	3.00	3.00
Sulphur (grains).....	12.7	13.2	13.9	13.8	13.9	13.4	14.0

B.

Date, 1876.	July 10.	July 17.	July 18.	July 20.	July 21.	July 24.	July 26.
Gas, cub. ft. per hour	.97	.625	—	.895	.652	.985	.659	.723	1.04
Rate of air to gas.....	6.6	10.0	10.2	5.2	8.9	4.7	9.8	9.1	5.5
Temperature.....	80°	80°	83°	83½°	86°	86°	88°	81°	83½°
Sulphur (grains).....	14.1	13.9	16.2	15.7	15.1	15.3	14.5	16.3	15.7

Atmospheric Properties of Compressed Air.

Some recent investigations of M. Paul Bert, relative to the properties of compressed air, bid fair to yield results of the highest interest in theoretical and applied science. Starting from the established fact that compressed air or oxygen causes the death of organisms subject to it, and adopting the theory that fermentations are due to the development of minute organisms, M. Bert has shown that compressed air acts as an admirable preservative of meat, eggs, fruit, vegetables, and many other substances. He cooked and ate mutton chops which had been submitted for a month to the action of compressed air, and was unable to detect any sign of tainting.

A curious result obtained was, that meat once submitted to the process, keeps indefinitely after the pressure is removed, care only being required to exclude the atmospheric dust capable of determining putrid phenomena. The experiments were succesful also in the case of diastatic fermentations—*i. e.* those caused by soluble ferments—and most important information will certainly be obtained regarding many physiological problems, such as blood poisoning, where uncertainty now exists as to the real nature of the ferments. The practical applications of compressed air are likely to be numerous and varied. The transportation of meat, fruits, and other perishable commodities will be vastly simplified by fitting up the hold of a ship with air-tight compartments; and it is suggested that the preservation of the dead can be easily effected for any required length of time by a simple application of this process. The use of ice will be to a great extent superseded, and a cheap and effective means of preservation will be obtainable in a large number of cases where there is now none.—*Exchange.*

Artificial Malachite—Artificial malachite which is susceptible to a fine polish, is made by precipitating a solution of sulphate of copper in the cold by carbonate of soda or of potash. The precipitate which is voluminous, should be allowed first to cohere, and is then dried and washed.—*Scientific American.*

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MONDAY, JULY 2, 1877.

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—ED.

Letter from Mr. P. Munzinger.

PHILADELPHIA, June 21, 1877.

Mr. Editor: By your pleasure I desire to give a portion of the results of my investigations of the "Lowe Gas Process".

A pamphlet issued by the Lowe Gas Company sets forth that they make illuminating gas equal to that of coal, that will not condense in pipes and tubes, of an uniform quality and almost free from carbonic oxide, at a less cost than coal, or any other gas made. It is also endorsed by some of our best gas engineers. After reading this pamphlet, I came to the conclusion that there must be some merit in this manufacture, and the first works I visited were at Manayunk, Pa. There I met Mr. Holmes, who explained the manufacturing, and also the quantity of material required, and labor. The apparatus, he explained to me, consisted of four generators, superheaters, scrubbers and washers; also a set of purifiers. He claimed that he could make 90,000 cubic feet with *one* of these generators in position, or 360,000 cubic feet with the four, but he used one only to *supply a portion of the gas delivered to consumers* of Manayunk; the remainder of the 300,000 cubic feet necessary for these consumers being made from coal on the same premises. After examining everything carefully, I asked Mr. Holmes how the consumers were pleased with this combination of gases, and he said it was perfectly satisfactory. I then visited a majority of the consumers, and found the complaints bitter and loud, and in many cases expressed in language more forcible than polite. Afterwards I visited Conshohocken and Phœnixville, towns a short distance from Manayunk, supplied with "Lowe gas" only, and found similar complaints. The fixtures in all these places were filled with a hard tarry substance.

The report of the investigation, alluded to by you in your article, the mysterious non-appearance of which you regret so much, if made public, would not be as encouraging as the statement that it was *made* seems to be; and it would not be profitable for Mr. Hilles, president of the Philadelphia Gas Trust, and also president of the Philadelphia and Manayunk Gas Light Company, if it was published, as that gentleman is largely interested in a new (opposition) works at Harrisburgh, Pa., lest it might injure the *sale of stock* in that company; it also might injure those speculators at Lancaster, Baltimore and Indianapolis, who expect to reap a handsome profit out of the so-called Lowe Gas Process. The time is not far distant when the speculators and stockholders will find that the gas made by the Lowe process is not as profitable in reality as it appeared in the prospectus, especially when they are in opposition to a coal gas company which is up to the times. The companies which have been manufacturing gas as when they started years ago, are now remodeling their works after the most approved works in Jersey City, New York and Brooklyn, and will give the Lowe opposition a chance to show itself, if worth anything.

I ask, if this process, as claimed by the Lowe companies, be so much cheaper than coal gas, why does the Utica Gas Company put in new benches, of six clay retorts each, this year, when they could have rebuilt their Lowe gas apparatus at a very trifling expense more than their new works are costing? Again why did not Mr. Lowe, at his own home in Norristown, where he had a plant after his own construction, and with every advantage with pipes laid through the city, go in competition with the old company?

How has that venture resulted? Ash that gentleman whom everyone knows, especially when financially embarrassed, by the name of Sheriff. Of course at Conshohocken and Phœnixville they are somewhat compelled to burn Lowe gas, it being a good deal like "Hobson's choice"—Lowe gas or none.

I believe I am fully alive to the great need of cheap gas, and so far from opposing any methods, am always willing to take hold of and prove not only to my own, but to the satisfaction of all my acquaintances among the gas manufacturers, any process that may be developed that promises to supply that necessity. But as yet I have not seen any method whereby gas can be made for illuminating purposes cheaper than from coal.

It is also very strange that the engineers and directors, especially of large companies, gentleman whose interests are so directly touched by cheap gas, should steadily refuse to use the various processes offered them, which promise to turn night into day at a nominal cost, and which can be sold at such enormous profit. Cannot this fact be taken as a proof that the supposed merits will not stand the test of actual experience? Although the most of these exploded humbugs have been tried in England and this country for the last half century and proved worthless, every few years they are again galvanized with a new name and a new patent, to bring gas companies and individuals to sorrowful bankruptcy.

P. MUNZINGER.

The Lowe Gas Process:

NEW YORK, June 22, 1877.

Mr. Editor: I was surprised to see, in a New York journal of June 2d, an editorial entitled "Competition in Gas Manufacture," not signed by any of its editorial staff, and evidently written by one of the Lowe people.

An article of similar character appears in your issue of June 16th. Now, I would respectfully ask, Mr. Editor, whether the proper place for these self-laudatory effusions is not in the paid advertisement column? You pertinently remark, in an editorial, that capitalists invest in gas undertakings, hoping to get a return therefrom in the shape of dividends. You might have added that the men controlling these undertakings are, as a class, the shrewdest and most capable, financially and practically, of the communities in which they live. It is a strange fact that these men in all the cities and large towns of the world, who, in all else, are able and far sighted, should be so densely ignorant and incapable, as not to understand and appreciate, the value of these water gas processes. They surround themselves by, and consult with the most eminent engineers and chemists not hesitating to pay liberally for the information obtained from those they consider competent to give it, and the result for the last seventy years has been that the financial returns from gas enterprises have been fairly remunerative.

Had the advice of uneducated, incompetent, and unsuccessful men (a class that frequently advocate new or immature processes) been taken, it is probable that the production of illuminating gas would, fifty years ago, have been abandoned as, commercially, a failure.

Of all the water gas processes now before the public, viz., the Tessie du Motay, the Gwynne-Harris, and the Lowe, it is certain that the latter possesses the least merit, and for the following reasons:

I. The meritorious parts of the apparatus for generating the gas are not original with Mr. Lowe, and any company using it would be liable to an injunction from other parties financially strong, owners of the patents above mentioned, and who, it is understood, stand ready to pounce upon the Lowe people as soon as their skeleton is clothed with meat. The Lowe company, root, trunk, and branch, being considered absolutely impecunious, could render no assistance in a legal contest.

II. The plant hitherto erected is defective in design, and seems to have been built without consideration for permanency, convenience, economy in working, or in accordance with what experience has suggested as best to those engaged in the production of illuminating gas.

III. The accidents resulting from the use of this process, even with the manufacture carefully supervised by those understanding it, and deeply interested in its success, have been more frequent and far more disastrous than by the other methods.

IV. The Lowe people have not, their statements to the contrary notwithstanding, hitherto had a scientific investigation of their process, giving the facts needed by any one caring to introduce it, and at all solicirous to its future successful working. The Gwynne-Harris company obtained at a large expense, a complete investigation from the hands of such chemists as Profs. Silleman and Wurtz their experiments, extending over many months. The Lowe people may consider the flying visit and inspection of Professor Wurtz, at Utica, a scientific investigation—most people don't.

V. The process has never been worked in a large gas works for the purpose of comparison with the so-called old time retort method. We except Utica, where the process failed disastrously. At Manayunk the production is understood to be but little over 2000 cubic feet per day, or less than one-third of the production of a single coal gas retort. This is very far from 251,000 cubic feet per day.

VI. The introduction of a new process, no matter how perfect, into a large establishment, is always attended by a greater or less number of accidents that cannot be foreseen, and the Lowe people have no one with them possessing either the mechanical or chemical knowledge, or the experience that should be had by any party attempting to produce a revolution in any manufacturing interest, affecting directly so large a number of people.

VII. No reasonable man can believe, without good evidence, that Mr. T. S C. Lowe should solve a problem that mastered such men, many of them eminently qualified, and fully supported financially, as Ruster, Jobard, Pelletan, Seguin, Down, Radley, Constable, White. Gielard, Donovan, Val Märing, Mauly Kirkham, Galy Cazalet, Sanders, George Lowe, Sellgue, assisted or advised by such renowned chemists or physicists as Dr. Fyfe, Dr. Frankland, Regnault, Barlow, etc.. etc.

VIII. The process in all its important features was invented, tried, and abandoned years ago by the National Coal Gas Co., a company that has had more experience, both as regards time and quantity, and by men qualified ten times over than the Lowe people'

IX. The introduction of this method into an existing works is far more expensive than the Gynne-Harris, rendering necessary the absolute abandonment of the present retort-house. and the erection of other, and expensive plant, differing entirely from that now in use. This increased, expenditure affects directly the interest account, adding to the expense of gas delivered. A gas works is also placed entirely at the mercy of the oil market, whereas, in an emergency, with the Gwynne-Harris method, it is possible, in a few hours to change from water to coal gas.

I cannot but think that the Lowe people admit the force of these nine propositions; whether so or not, they must prove their negative before receiving the confidence of others.

Now if we look at the water gas question broadly, and not as developed by any particular method, we find there are certain financial objections which render its introduction, at the present time, unadvisable, as follows:

I. In the economical manufacture of water gas so large a percentage of carbonic oxide is produced, that, irrespective of the question that the distribution of such a gas will, sooner or later, be prevented on account of its danger, and one or two accidents will be sufficient to bring this about; a very large quantity of hydrocarbon vapor is required to naphthalize it.

II. The wear and tear of all water gas processes have hitherto been enormous, and there is no apparent reason why the Lowe does not come in the same category.

III. It can be shown that the cost of 1000 cubic feet of coal gas of sixteen candle power, including all expenses, in the holder, with the present cost of coal and labor, and with a fair market for residual products, is but little, if any, greater than the oil alone (taken at a fair price) required to naphthalize 1000 cubic feet of water gas.

Now when we add to the oil the cost of 1000 cubic feet of water gas, we have increased the cost largely. This estimate would apply to any well managed works, favorably situated, so as to take advantage of the economical delivery and handling of their supplies and products.

I notice, Mr. Editor, that you state it takes about 16 lbs. of pure carbon to convert enough steam into hydrogen and carbonic oxide to make 1000 cubic feet of this mixture, and 24 lbs. of water to make the steam. This is correct, if based upon the theory of the perfection of the water gas manufacture, viz., so as to produce equal quantities of cydrogen and carbonic oxide. But in practice these results are not obtained, so that the quantity of carbon used is largely increased, running from the lowest 90 lbs. up to 300 lbs. per 1000 cubic feet.

The amount of water to be converted into steam is also largely increased. More than twenty years ago Dr. Fyfe found, with the White process, similar, in essentials, to the Lowe process, that it required 147 lbs. of water to produce 1000 cubic feet of water gas.

There is an aphorism among members of the bar as to what counsel should do if he has no case; this course carried out is sometimes successful with the jury, but always fails with the court. I see the evidence of such a policy among those who must know that all meritorious projects, for bettering and cheapening the production of gas, have been, and always will be, well received and liberally paid for, by those most interested in their success, viz., the existing gas companies. The stand taken by some engaged in developing new processes, is the worst that could be devised for their success, and is an evidence, not of their success, but of the appreciation by their promoters of the ancient retort method.

The words of a celebrated English physicist, written many years ago, in reference to the Gillard process, appropriately close this letter.

"Assuming that the concoctors of the bubble are acquainted with its baseless structure, we cannot imagine that they seriously intend to carry the process into operation; and the real object of the efforts that are being made to introduce it into some of the towns is, we suspect, under the disguise of such a specious fallacy, to establish works and lay down pipes for the manufacture and distribution of coal gas.

MORE ANON.

Letter from Mr. W. P. Fish.

UTICA, June 21, 1877.

Mr. Editor: Having read with interest your comments on Mr. Dwights letter, I desire, as a stockholder in gas companies, to thank you for the opinion expressed as to the duty of a manager in reporting to his directors the investigations he may make of the many so-called improvements that are constantly presented. The laboratory tests, and the experimental results obtained by chemists and inventors, though of great value, are not always reliable data for dividends. It is of quite as much importance for the directors to know if the scientifically correct idea is also practical, and if so, will it prove profitable as the knowledge of the exact constituants of the gas they propose to sell consumers. I also agree with you that there is no manufacturing enterprises which so readily seizes upon, and adopts ideas which have been proved advantageous to their interest, as the older gas companies of the United States.

Receiving, daily, many letters from readers of the JOURNAL, inquiring as to the results obtained with the "Lowe process" at Utica, I give you the following *facts* which may interest them:

The building and apparatus used for the "Lowe process were never perfect. On the contrary, they required constant attention for the first three months they were in use.

It was on the order of the otherwise intelligent person in charge of the works, and against the remonstrance of the workmen, that the main pipe leading to the purifying-house was opened without closing the valve to the gas-holder. The result was the escape of gas through a six-inch opening, and the destruction of the building by fire. It did not fortunately result in an explosion and loss of life, as in a similar occurrence at Manchester, England.

The first difficulty encountered in the distribution of the water gas was from the stoppage of service-pipes and fixtures with naphthaline, which had been dissolved from the mains by the new gas, and again deposited in the small angles and openings in the connection pipes. This trouble lasted some three weeks, and did not reoccur.

In the vicinity of the gas works, petroleum-tar made its appearance in keys and burners of fixtures, and did not disappear until the erection of a crude apparatus for the purpose, removed the tar at the works, and the complaints ceased.

During this time the sulphur and ammoniacal compounds in the gas had not been removed, and although there had been no complaint from consumers, as to disagreeable odors in the gas, it was found advantageous to treat the crude gas with lime purification.

From the latter part of June to November 8, 1875 during which time the Lowe process was used alone, the gas was superior in illuminating power and freedom from impurities to any furnished the city before or since.

The gravity of the gas during this time averaged .578, and five feet of it consumed in an open burner equalled nineteen sperm candles burning 120 grains per hour.

On a few occasions when the whole capacity of the generators could be utilized (160,000 feet in 24 hours), the gas was made with an expenditure of less than 50 lbs. of coal, and $3\frac{3}{4}$ gallons of oil to each 1000 feet of gas made. This includes all the material used; making the steam, heating the building, furnishing power to the engine, decomposing the steam into gas, and carburetting the gas.

The average results were different. Take the quarter ending December 1, 1875.

Whole am't of water gas made 9,993,2000 ft. st. meter.
Whole am't of coal for all purposes 699,322 lbs.
Whole am't of oil used for carburetting 32,400 gals.

70 3-100 lbs. of coal, and $3\frac{1}{4}$ gallons to each 1,000 feet of gas made. The difference between the stationmeter and the gas for which the company received pay was 2 per cent. less than in 1874, and about the same as 1876, during the corresponding months. It required one bushel of slacked lime to 4,800 feet of gas made to purify.

Experience of eight months showed but a trifling decrease in the amount of gas used by individual consumers, which can be accounted for by the increased pressure used.

The men employed in the generating-room lost no time from sickness during the eight months the water gas was used.

The man who attends to the tapping of the street mains could not attend to as many in a day, as when the gas was made from bituminous coal. Two men in the employ of the company were rendered insensible by inhaling the gas escaping from a broken main. They were brought to consciousness with a pint of strong whiskey, and were at work the next day.

All these men are at the present time in good health, and are at work.

My opinion is, that the decomposition of steam by carbon in the form of anthracite coal, and carburetting it with petroleum oil, by the Lowe process, does not result in a gas containing 30 per cent. of carbonic oxide, and that there is not enough poison in the gas to destroy life, when inhaled in sufficient quantity to render a person insensible.

Yours Respectfully,
W. P. FISH.

Inclined Retorts.

June 16, 1877.

Mr. Editor: Would some of the readers of the GAS-LIGHT JOURNAL give me the information, whether there has been any of the present form of retorts (D's or Ovals) set on the inclined principle, the fall being from front to back. If so, what has been the cause of their failure.

The reason I ask those questions is, that I think such a form of setting the retorts could be easily charged and drawn by machinery, if they were set at such an inclination that the coal could be readily slid into them, without it packing, and the coke pushed out at back the end.

We are using a machine for charging, and find it a difficult matter to do so in horizontal retorts. If they are partly broken or filled with carbon, it will prevent any machine that has to go into the retorts, from charging them, which could not be the case in the inclined retorts, as they can be charged in all conditions. There are objections to such a setting, but they might be counterbalanced by saving in labor. Hoping to get the information required.

I remain yours very truly,
MANAGER.

Rules for Calculating the Weight of one Foot in Length of Round, Square, Octagon, Hexagon, and Flat Steel.

BY P. W. DURFEE, ENGINEER.*

The following rules for computing the weight of a lineal foot of those sections of steel in common use have, in the absence of tables, been found by the writer very convenient and sufficiently accurate for most practical purposes:

Rule for Round Steel.—Square the numerator of the fractional expression of the diameter of a bar whose weight is required, and divide this square by the number in the following table opposite the denominator of the fractional expression taken, and the result is the weight in pounds of one foot in length. If the diameter is expressed in

64ths of inches, divide the square of the numerator by					1536.
32ds	"	"	"	"	384.
16ths	"	"	"	"	96.
8ths	"	"	"	"	24.
4ths	"	"	"	"	6.
$\frac{1}{2}$	"	"	"	"	1.5

* "Journal of the Franklin Institute."

If the diameter is expressed in
Inches, divide the square by..... 0.375

Example.—Required the weight of one foot in length of $\frac{7}{8}$ round steel:

$7 \times 7 = 49 + 24 = 2.0416$ lbs per foot.

Rule for Square Steel.—Square the numerator of the fractional expression of the side of the bar whose weight is required, and divide this square by the number in the following table placed opposite the denominator of the fractional expression taken, and the result is the weight in pounds of a foot in length. If the side of square is expressed in

64ths of inches, divide the square of numerator by					1152.
32ds	"	"	"	"	288.
16ths	"	"	"	"	72.
8ths	"	"	"	"	18.
4ths	"	"	"	"	4.5
$\frac{1}{2}$	"	"	"	"	1.125

If the side ot square is expressed in
Inches, divide square of side by... 0.281

Example.—Required the weight of one foot in length of $1\frac{1}{4}$ inches square steel:

$1\frac{1}{4}$=5-4 $5 \times 5 = 25 + 4.5 = 5$ 5 lbs. per foot.

Rule for Hexagon Steel.—Multiply the weight of round steel of the same nominal dimensions as that of the hexagon steel whose weight is required, by 1.1, and the result is the weight in pounds of one foot in length.

Rule for Octagon Steel.—Multiply the weight of round steel of the same nominal dimensions as that of the octagon steel whose weight is required, by 1.054, and the result is the weight in pounds of one foot in length.

Rule for Flat Steel—Multiply together the numerators of the fractional expression of the width and thickness of the bar whose weight is required, taken in the same denomination of fraction, and divide the product by the number in the following table placed opposite the denominator of the fractional expression taken, and the result is the weight in pounds of one foot in length. If dimensions are taken in

64ths of inches, divide product of numerator by					1152.
32ds	"	"	"	"	288.
16ths	"	"	"	"	72.
8ths	"	"	"	"	18.
4ths	"	"	"	"	4.5
$\frac{1}{2}$	"	"	"	"	1.125

If dimensions are expressed in
Inches, divide product by..... 0.281

Example.—Required the weight of a lineal foot of $\frac{3}{4} \times 1\frac{3}{8}$ steel:

$(\frac{3}{4} \times 1\frac{3}{8}) = (6\text{-}8 \times 11\text{-}8)$, then, $6 \times 11 = 66 + 18 = 3.66$ lbs. per foot.

The foregoing rules give weights slightly in excess of those due to the dimensions of the bars taken, but as in most cases, steel is found to exceed its nominal dimensions. The rules will be found to give results approximating very closely to the actual weight of the various sizes of steel in common use.—*Am. Artisan.*

Chemical and Scientific Repertory.

Pressing Cotton Bales in Vessels.—Hydraulic pressure, applied laterally, is now quite common; effecting about 25 per cent. increase in the cargo —*Polytechnic Review.*

Gas Given off by Apples.—C. Bender.—The gas, very carefully collected, was found to consist of—

Barbonic acid	40·20
Oxygen	0·43
Nitrogen	59·37

The oxygen is probably an impurity.—*Chemical News.*

Gas from the Capsules of Colutea Arborescens.—C. Bender.—The gaseous mixture consisted of

Carbonic acid	2·2
Oxygen	18·7
Nitrogen	79·1
	100·0

—*Ibid.*

A New Explosive.—An explosive has been introduced under the name of pantopolite. It consists of nitroglycerin dissolved in naphthalin. The fumes developed on its explosion are extremely distressing, producing violent pain in the head and chest.—*Ibid.*

The Fir Tree.—M. Chatin has lately directed the attention of the French Academy to some curious periodic movements in the leaves of the fir tree known as *Abies nordmanniaua*, which are whitish on the lower and dark green on the upper surface. If the tree be observed early in the morning or about sunset, the general effect of the foliage is whitish; whereas, in the course of the day the green tint becomes very general. This is found to result from an alteration in the position of the leaves, so that they present now their upper, now their under surface to the observer; and a diurnal position can thus be distinguished from a nocturnal one. M. Chatin has been studying these movements, and promises some further details regarding them shortly.—*Evening Post.*

To Transfer Pictures.—Pictures may be transferred to painted surfaces in the following manner: Cover the ground with an even coat of light colored carriage varnish, which should be allowed to set (nearly as dry as if for gilding). If the print to be transferred be colored, soak it in salt and water; if not colored, use water alone. Remove superfluous water by pressing between blotting pads, and then place the picture face down upon the varnish, pressing it smooth. When the varnish is dry, dampen the paper and rub it off with the finger. The picture will be found upon the varnish, and another coat of the latter should be added to bring out the effect. This process answers equally well for glass or metal surfaces.—*Scientific American.*

A Recent German Invention.—Among recent German inventions is a simple process, depending on the use of acetate of lead, by which every kind of painting is applicable to sheets of zinc. By mixing black lead, for instance, with the salt, a very agreeable light brown hue is obtained. It is by this process that the cupola of the synagogue at Nuremberg has been painted, a sufficient length of time having already elapsed, it is said, to show that the atmosphere has had no influence on the zinc sheeting of the roof, thus showing the peculiar adaptability of the process in such cases. By the addition of other coloring matters, light or dark shades of yellow or gray may be produced.—*The Western Manufacturer.*

Gas-Light Intelligence.

United States.

The Dangers of Gasoline.—John Geratly, a lamplighter, living at the corner of Second avenue and 110th street, while lighting a gasoline lamp at Third avenue and 108th street, saturated the sleeve of one arm while filling the lamp, and on lighting it set himself on fire, and was so severely burned that his arm is a mere crisp.—*Telegram.*

Pawtucket (R. I.) Gas-Light Co.—The Board of Directors of the Pawtucket Gas-Light Co. met at the rooms of the Pacific National Bank, Pawtucket, and elected the following officers:

William Newell, Central Falls, President.
I. R. Darling, Pawtucket, Secretary.
Thomas Moies, Central Falls, Treasurer.
S. G. Stiness, Central Falls, Superintendent.
F. A. Newell, Central Falls, Collector.

The company voted to reduce the price of gas on the 1st of July to $2.60 per thousand cubic feet, with 5 and 10 per cent. off to large consumers. We are informed that there are but three gas companies this side of Philadelphia which sell gas at a less average price. Notwithstanding the low price at which they furnish their gas, they make a superior article, have always paid a good dividend, and the works have been kept in first-class shape. These results speak well for the management.—*Exchange.*

Woven Materials Impervious to Gas and Water for Dry Meters, Etc.—A want long felt, as in the construction of dry meters, etc, of a good elastic material, impervious to water and to burning gas, and at the same time unaffected by hydrocarbons condensing from the gas, or impurities in it, has been met, according to Dr. Tieftrunk, by an article recently produced by Engineer Schilike, which will doubtless meet with many applications. Dry meters, in which it has been employed, have not been noticeably affected by use for half a year. Dry pressure regulators made with it have also been found very superior to the wet ones generally in use, and Dr. Tieftrunk states that by means of them he can regulate the temperature of an air or oil bath so that the highest variation will not exceed 2°. The article consists of woven material, impregnated with a substance that precipitates in the pores, and which combines a high degree of elasticity with the requisite strength, and is not rendered sticky, and does not lose in imperviousness or elasticity under the influence of the hydrocarbons present in burning gas. A sample was not impaired in any of these particulars by an immersion of three days, at a constant temperature of 104°, in hydrocarbons extracted from gas by cooling it to 4° below zero. The same was true after digestion with a solution of carbonate of ammonia, and with bisulphide of carbon.—*N. Y. Tribune.*

Prices of Gas Coals.

We have no change to note in our quotations:

Westmoreland	$5 50	$4.50	at Baltimore.
Penn	5.50	4.50	
Despard	5.35		
Marion	5.35		
Murphy Run	5.35		
Ches. and Ohio R.R. Caking Coal	5.40	4.25	at Richmond.
Block House	4.50	1.75	Gold f. o. b. at Mines.
Glace Bay	4.25	1.60	
International	4.25	1.75	
Clover Hill	4.00		
Newcastle	4.25		
Cannelton Cannel	10.00		
Peytona	10.00		

Unlike other branches of the coal trade, a reduction in prices would not add materially to the gross sales of gas coal of the year, for while the comparatively low prices will lead to the securing of ample supplies until the spring of 1878, most companies prefer to take the risk of higher prices next year (of which there is not now much prospect), to carrying extra stock, with the attendant expenses of storage, etc., and the certainty of depreciation in quality in the meantime, With the exception of what Provincial coal is required, the supplies for New York are now pretty nearly all arranged for, and the business for the next six months will be mainly one of detail in supplying coal already contracted, for most of the New England companies have left openings for Provincial coal, and the importations from that quarter bid fair to largely exceed those of last year; this, too, in the face of the fact that American gas coals delivered in New York, are lower than ever before known. This is accounted for partly from the general desire on the part of the gas companies to economize in the cost of their supplies, and the gradual removal of the prejudice that has existed against the use of the Provincial coals, together with the fact that they are more carefully shipped than formerly.

The shipment of coal from the Block House mines o the States this season, to date, has been 9,568 tons or New York, and 2,187 tons for New England.

Practical Hints about Gas Burners.

Most people who have experimented upon their gas burners at all, have tried the plan of fitting over the burner a small additional tip. This tip soon grows hot, and a larger flame with more light is obtained It has been argued, however, that the additicnal light thus obtained was chiefly due to the more rapid flow of the heated gas, and thus there was no economy attained. The experiments of Dr. Karl Huemann, detailed in *Liebig's Annalen*, will start anew a discussion on this subject. He upholds the old idea that the light of flame is usually contributed by solid, not gaseous particles of carbon. This is in opposition to the views recently enunciated by Dr. Frankland. If the combustible matter be diluted with inferior gases, Dr. Huemann says, it will require a higher heat to make it luminous. A practical feature in his researches is the declaration that light is notably diminished by the use of metallic burners The substitution of a non-conducting material, such as steatite, for the ordinary iron burner, is advised. By raising the temperature of the issuing gas and of the burner, a marked increase of light was obtained and, this, it is positively stated, was done with out a greater flow of the gas. The higher results were attained when the burner was heated close to the orifice. But Dr. Huemann insists that extra heat for the burner must not be contributed by the luminous flame itself. He declines to enter into the economical question as to whether heating the gas and thus obtaining brighter light is or is not a profitable operation.—*Polytechnic Review.*

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,

24 Pine Street, New York City.

July 2, 1877.

☞ All communications will receive particular attention

	Capital.	*Par.*	*Bid.*	*Asked.*
Gas. Co.'s of N. Y. City.				
Central, Westchester	466,000	50	90	95
Harlem	$1,850,000	50	100	105
Manhattan	4,000,000	50	190	195
Metropolitan	2,500,000	100	130	132
" Scrip	$1,000,000	...	100	103
" Bonds	500,000	1000	92	94
Mutual	5,000,000	100	92	94
" Bonds, gold.	900,000	1000	105	—
Municipal	1,000,000	100	70	80
New York	4,000,000	100	125	130
Suburban, W'stch'str	390,000	50	—	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	155	160
Citizens	1,200,000	20	80	85
" Scrip	220,000	1000	95	97½
Peoples	1,000,000	10	30	35
" Bonds	$ 325,000	...	—	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	—	75
Nassau	1,000,000	25	80	85
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	120	125
" Scrip		...	100	103
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	55	—
" Bonds	200,000	1000	—	90
Baltimore, Md	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	100	105
" " Bds.	124,000	—	—	—
Cincinnati G & C Co				190
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	184	186
Hempstead, L. I	25,000	100	...	—
Jersey City	386,000	20	160	—
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohi'o	60,000	100	—	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	150
Long Branch		20		95
Peoples, Jersey City		...	120	125
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	76	—
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y.		100	50	60
Richmond Co., S. I.	300,000	...	97	100
Woonsocket, R. I.	150,000	100	100	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			111	112
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Saugerties, N. Y	15,000	100	110	115
Troy, Citizens	600,000	100	—	60
Toledo, Ohio			95	97½

Manhattan Gas Company has declared a dividend of 5 per cent., payable Ju y 2d.

Six shares of Metropolitan gas stock, sold at auction, @ 100½. 150 shares of Nyack and Warren gas, sold for $200 for the lot. 20 shares of Manhattan gas sold @ 196.

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Secretary and Cashier Wanted

FOR A COAL GAS CO·,

IN A RAPIDLY GROWING WESTERN CITY,

WHO CAN INVEST

A few Thousand Dollars

IN THE STOCK OF THE COMPANY.

Satisfactory reference, and ordinary business qualification required. Former knowledge of gas business not essential. Address A. M. CALLENDER & CO., 42 Pine street, New York City. 433-2t

TO GAS COMPANIES.

POSITION WANTED AS **ENGINEER, SUPERINTENDENT, or DESIGNING DRAUGHTSMAN.** Understands *thoroughly* the manufacture and manipulation of Gas, as well as Construction of Gas Works, etc. Address **C. C. J.,** care of A. M. CALLENDER & Co., 42 Pine Street, N. Y. 433-1t

OFFICE OF THE

NATIONAL COAL GAS COMPANY,

No. 4 Warren Street, New York.

H. P. ALLEN, President.
I. B. BRICE, Vice-President.
A. H. ALLEN, Secretary.
WM. J. VALENTINE, Treasurer.
GEORGE W. HARRIS. Engineer.

This Company is the owner of the GWYNNE-HARRIS, or AMERICAN HYDROCARBON process, for making Gas for Lighting or Heating purposes, by the perfect decomposition of superheated steam, under what is known as the

GWYNNE AND HARRIS PATENTS.

This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

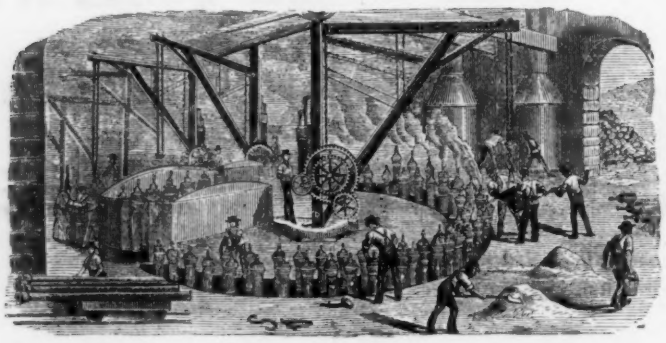
The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with t use of "petroleum and its products"

Further information, and terms of sale of rights will given, upon application to the Company 348-1y

M'NEALS & ARCHER,

BURLINGTON. N. J,

Flange-Pipes



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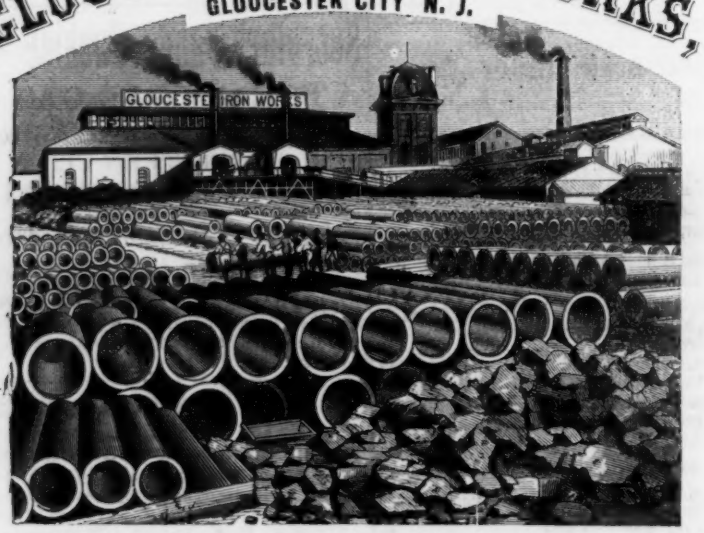

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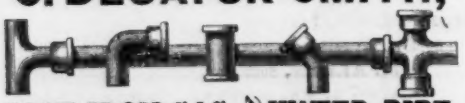

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Foundry, Cor. of York and Moyer Streets,

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Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS. ☜

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MANUFACTURERS OF

CAST IRON GAS & WATER PIPE,

BRANCH CASTINGS, LAMP POSTS, Etc.

(Pipe from three inch and upwards cast *vertically* in 12 feet lengths.)

HEAVY AND LIGHT CASTINGS OF ALL KINDS.

DAILY CAPACITY 125 *TONS.*

☞ Our Works *connect direct* with *eleven railroads* centering in this city, giving us unequalled facilities for shipping to all points, at the lowest rates of freight. 405-1y

B. S, BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

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BALTIMORE, MD.

NATIONAL FOUNDRY

AND PIPE WORKS.

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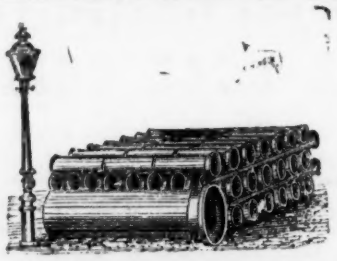
WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, and all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purhase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.

☞ SEND FOR CIRCULAR AND PRICE LIST. ☜



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Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

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A SITUATION AS

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GAS COAL COM'Y
Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favor able terms.

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351-1y

PEYTONA CANNEL COAL,
FROM WEST VIRGINIA.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

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THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
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C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N, Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

294-1y n

THE DESPARD COAL COMPANY
OFFER THEIR SUPERIOR
DESPARD COAL

To Gas Light Companies throughout the country.

Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

*** Reference to them is requested. 204-

TYRCONNELL GAS COAL.,
MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little Ash and scarcely any clinker 54-1y

MAKE your own GAS

GAS GENERATORS, FOR LIGHTING Dwelling-Houses, Public Buildings, Churches, Factories, etc., etc.

Send for CIRCULAR.

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GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,
AND PREPARED FOR
GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

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366-1y

CANNELTON COAL COMPANY
OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

acknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 cubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb. —gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

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For delivery at any Port in the United States.

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THE WAVERLY COAL AND COKE CO.

Offer for Sale the

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DOUBLE SCREENED,

from their Colliery at Smith's Mills, on the Youghiogheny River, thirty-seven and a half miles southerly of Pittsburgh. This Coal has the preference in Pittsburgh over all other YOUGHIOGHENY COAL for GAS PURPOSES.

The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

Full particulars can be had by addressing

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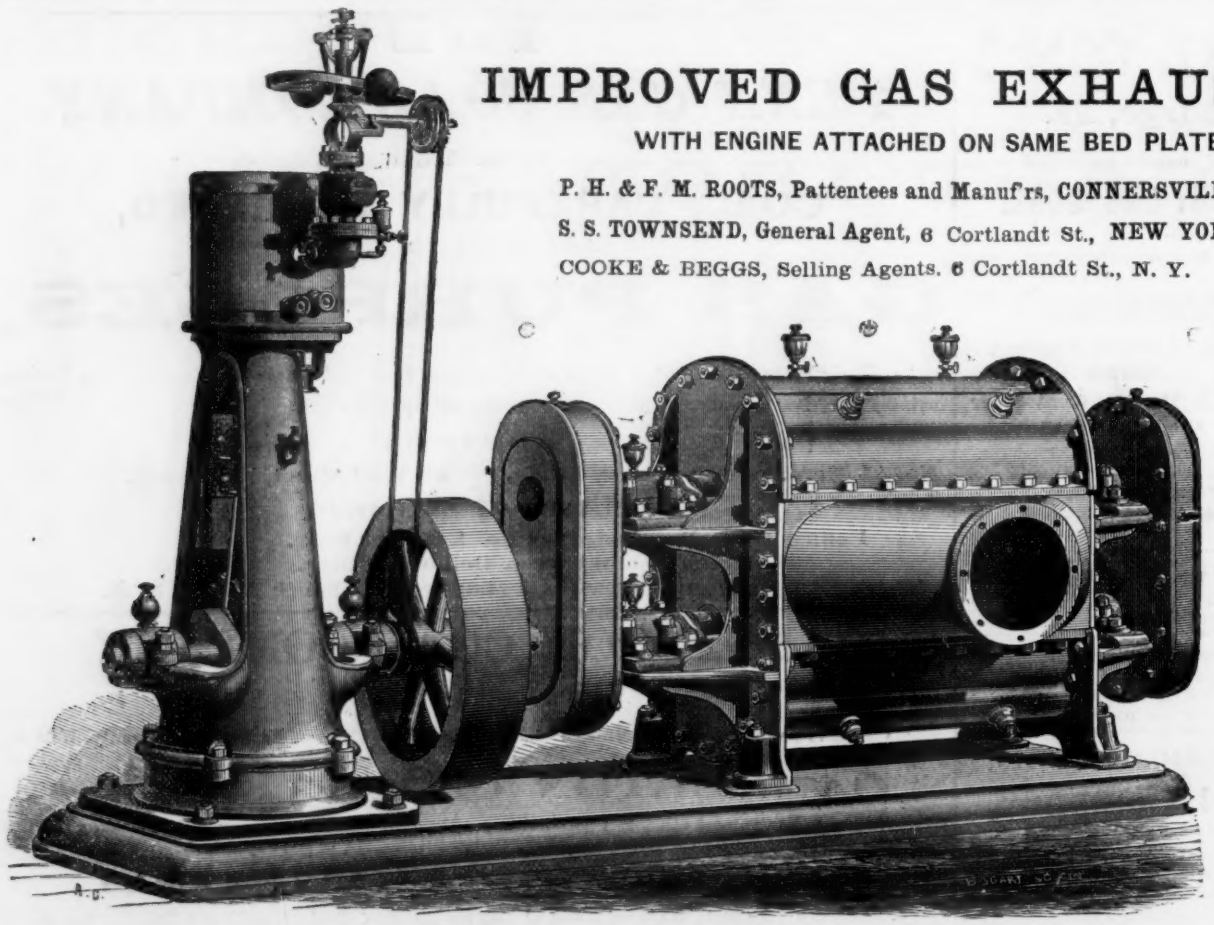

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928 to 954 River Street and 67 to 83 Vail Ave

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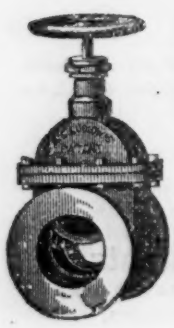
BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ¾ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—

HYDRAULIC MAIN DIP REGULATORS.

ALSO

FIRE HYDRANTS.



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Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

☞ Articles of every description made to order at short notice. 1)5

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Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,

ALWAYS ON HAND.

J. H. GAUTIER.
C. E. GREGORY.

393-1y

Brooklyn Clay Retort

AND

FIRE-BRICK WORKS

VAN DYKE STREET, BROOKLYN, N. Y.

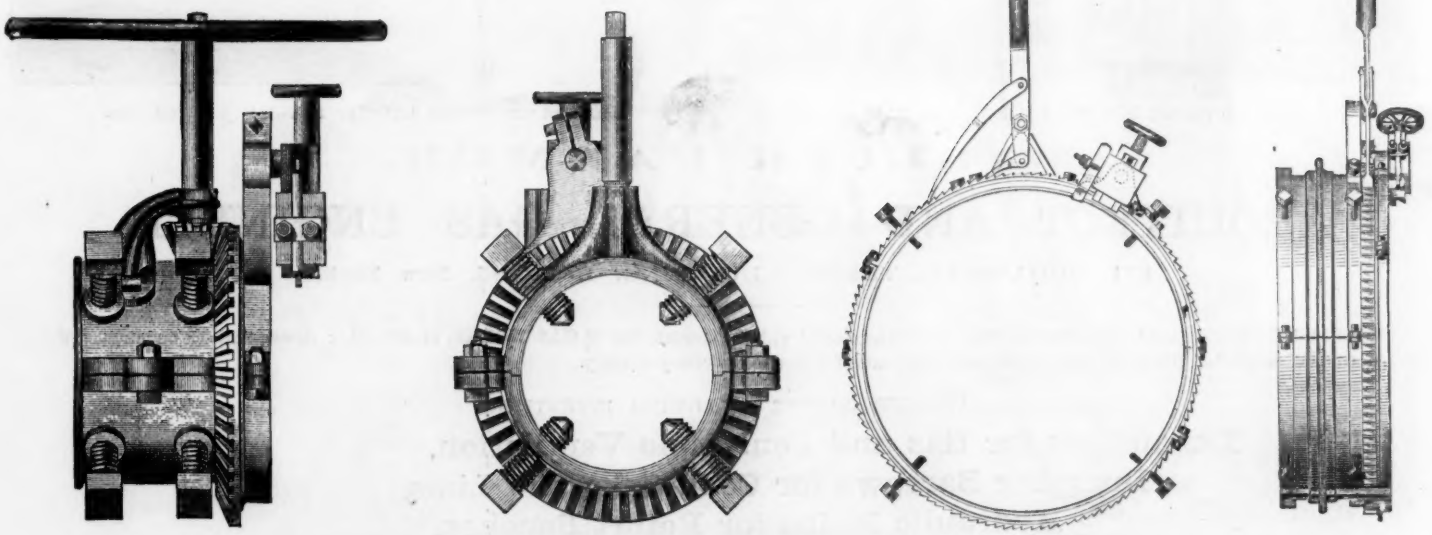
EDWARD D. WHITE Surviving Partner of the late firm J. K. BRICK & CO. 402-1y

A. C. WOOD'S PIPE CUTTER.

PATENTED MAY 23rd, 1876.

THIS IS THE ONLY HAND MACHINE IN THE WORLD FOR CUTTING

CAST IRON PIPE.



It will cut Cast or Wrought Iron Pipe, Shafts, or Columns of any size, making a clean, smooth, and square cut. Also,

A Continuous Line of Pipe in a Trench or Building.

Our Machines for cutting 30-INCH PIPE have been furnished to the Manhattan and New York Gas Light Companies, and operate to their entire satisfaction. The smaller sized Machines have been in practical use for more than a year with the most satisfactory results. For further information address

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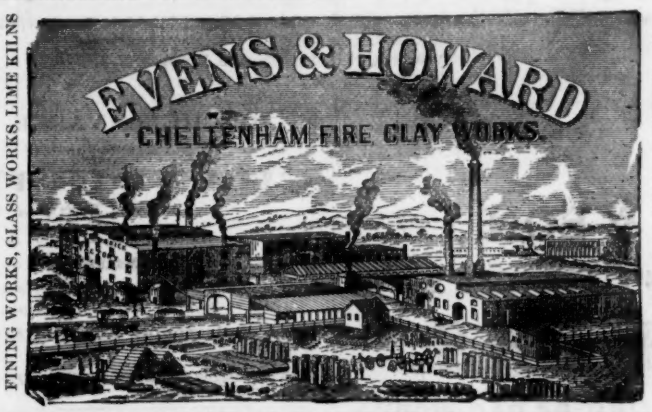

SILICA BLOCKS FOR FOUNDRY CUPOLAS, BESSEMER TUYERES, CUPOLA LININGS, BOILER TILES, GREEN HOUSE TILES, FINE GROUND BRICKS, FINE, GROUND FIRE-CLAY, FIRE SAND, WASHED FIRE-CLAY Etc., Etc. PORTLAND AND THE HYDRAULIC CEMENTS CONSTANTLY ON HAND.

THROUGH CARS LOADED AT FACTORY FOR ALL ACCESSIBLE POINTS.

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RETORT WORKS.

ESTABLISHED IN 1845.

BRANCH WORKS AT KREISCHERVILLE, STATEN ISLAND.

B. KREISCHER & SON,

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Gas Retorts, Tiles and Fire Brick

OF ALL SHAPES AND SIZES.

Fire Mortar, Clay and Sand.

Articles of Every Description made to Order at the shortest notice.

FOR SALE.

AN EXPERIMENTAL HOLDER

OF

300 Cubic Feet Capacity

WITH

WROUGHT IRON COLUMNS,

COUNTERBALANCES, ETC., ETC.,

IN COMPLETE WORKING ORDER.

To be seen at the Works of the

NEW YORK GAS-LIGHT COMPANY,

Twenty-First Street and Avenue A,
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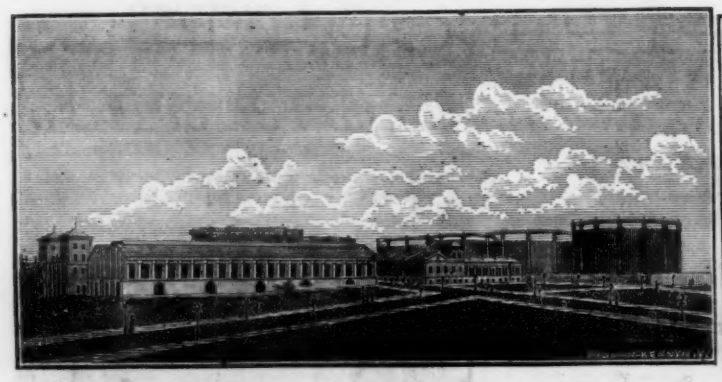
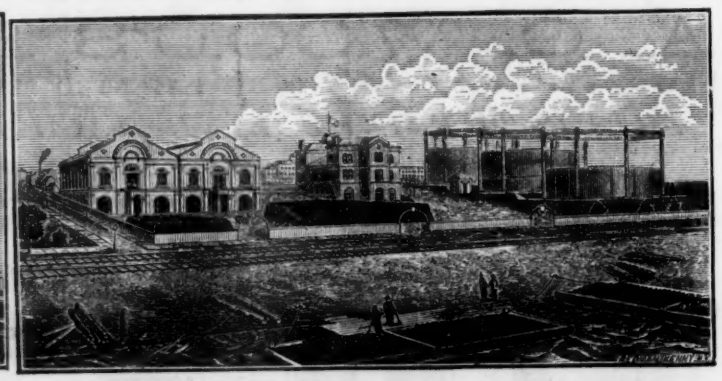
Where full particulars, as regards price, etc, may be obtained.

To Take Rust Out of Steel.—Place the article in a bowl containing kerosene oil, or wrap the steel up in a soft cloth well saturated with kerosene: let it remain 24 hours or longer; then scour the rusty spots with brickdust. If badly rusted use salt wet with hot vinegar; after scouring, rinse every particle of brickdust or salt off with boiling hot water; dry thoroughly, then polish off with a clean flannel cloth and a little sweet oil.—*Scientific American.*

The Electric Light.—Experiments with the eleteric light as a head-light for locomotives have recently been made in Russia, on the railroad from Moscow to Kursk, with successful results. The apparatus consisted in a battery of forty-eight couples, which produced sufficient illumination to light up the track for a distance of from 1,500 feet to 1,800 feet ahead. A correspondent of *Les Mondes* suggests that a small electric machine would serve the purpose much better than a galvanic battery liable to injury by agitation. It is proposed to connect the mechanism directly with the front axle, the revolution of which will set the former in operation. The chances of danger usually augment with the speed, but, arranged as above described, the intensity of the light would increase in like ratio up to certain limits. In running slowly the illumination would be comparatively feeble; but in such case the bell, whistle, or other signals would afford warning in ample time.—*Engineer.*



CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM. FARMER, ENG.



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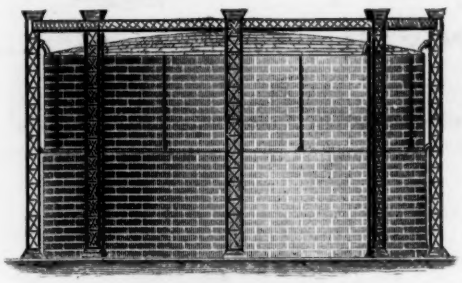

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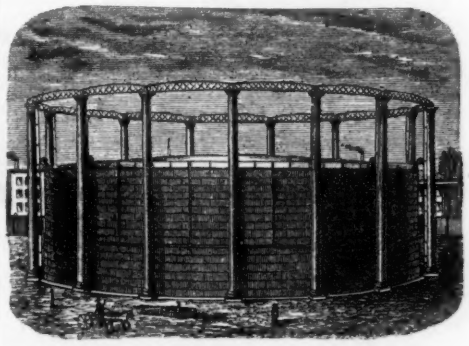

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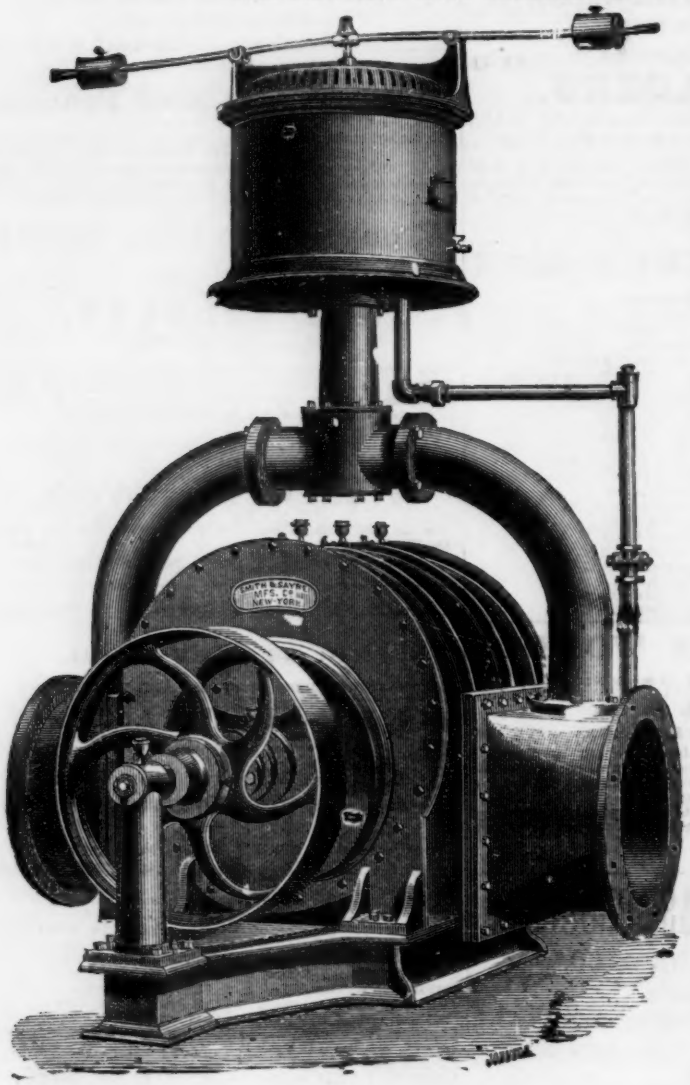

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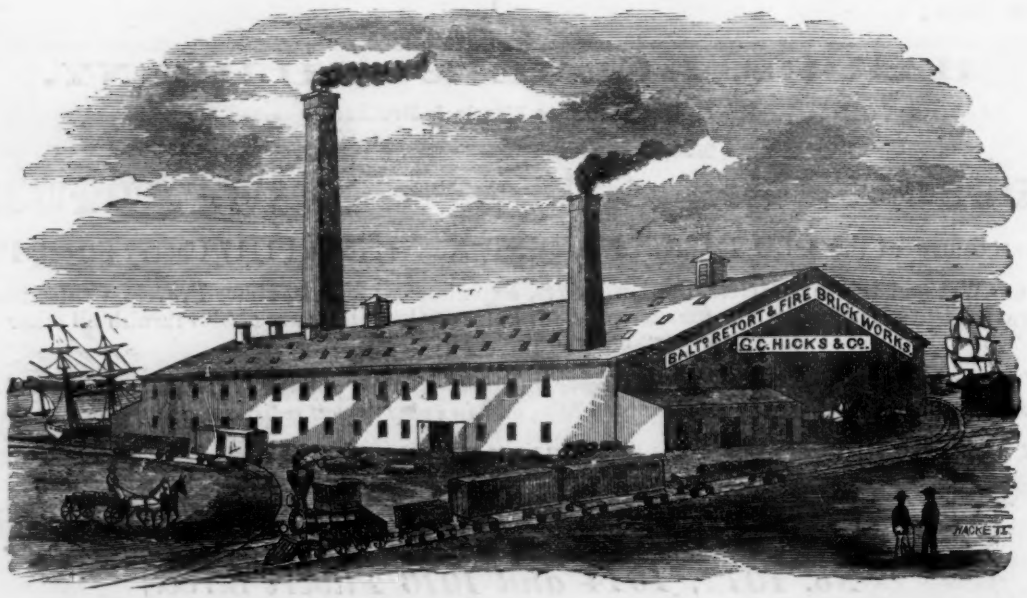

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"Dear Sir,

"Among the letters which you placed in my hands for examination regarding the general standing of your fire clay, gas retorts, and gas furnace, bricks, &c., there were a number from the leading gas manufacturers of the U. S., speaking in the highest possible terms of their durability, freedom from the accumulation of condensed carbon, and general excellence. I regret that these letters are mislaid, or still remain in the Judges' room at the Centennial. I suppose you are aware that your retorts were awarded a First Premium at the Centennial.

"Yours truly, E. T. COX," *of the Centennial Jury of Awards.*